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# A splitting-after-merging approach to multi-FIB compression and fast refactoring in virtual routers

**Key words:** Virtual routers, Merging, Splitting, Compress, Fast Refactoring

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# Introduction

- virtual routers have multiple virtual instances coexisting on a physical router platform, and each instance retains its own forwarding information base (FIB). memory scalability suffers from the limited on-chip memory.
- we present a splitting-after-merging approach to improve the memory efficiency and offer an ideal split position to achieve system refactoring.
- 14 real-world routing data sets show that our approach needs only a unibit trie holding 134 188 nodes, while the original number of nodes is 4 569 133

# Splitting-after-merging approach

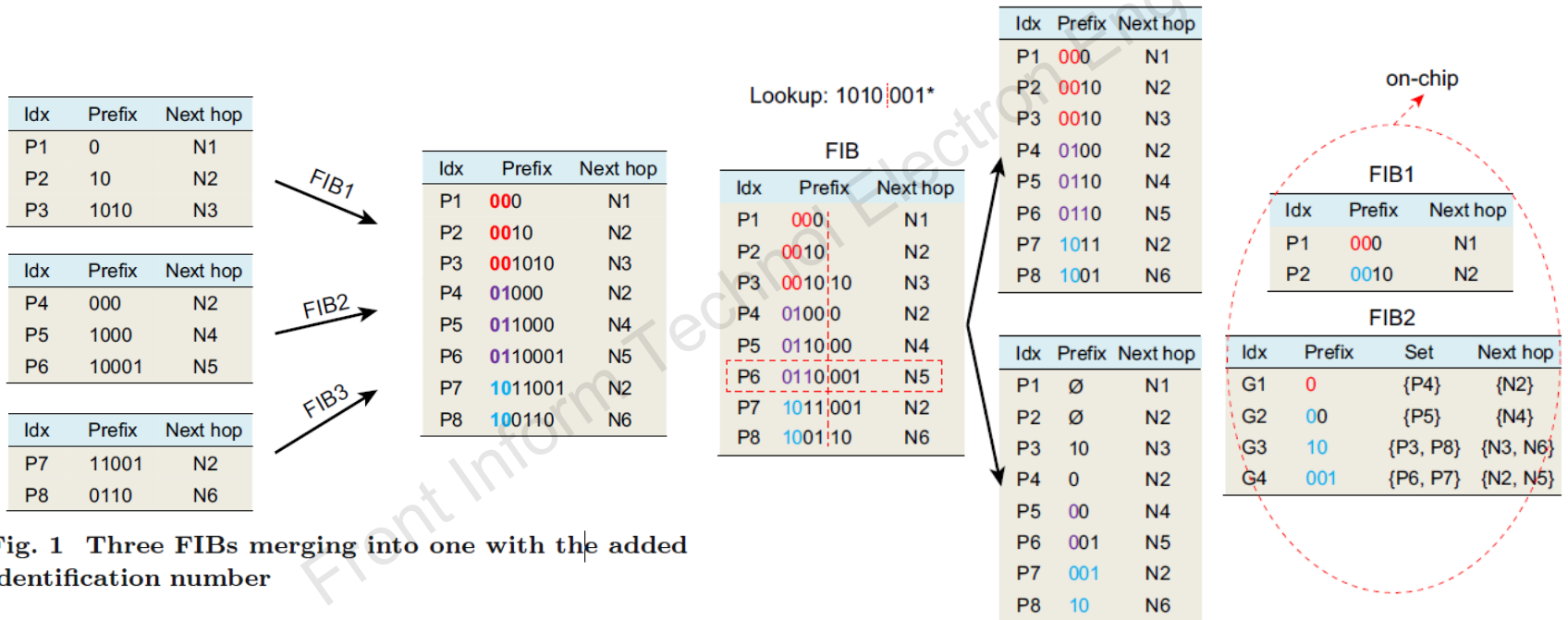


Fig. 1 Three FIBs merging into one with the added identification number

Fig. 2 Splitting the merged FIB into two FIBs

# Prefix splitting

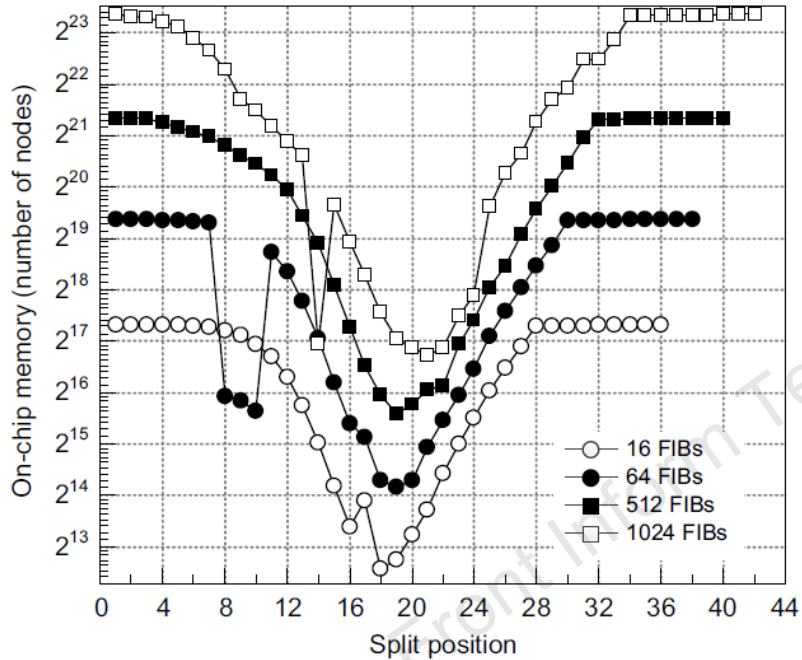


Fig. 3 The trend of on-chip memory varying with split position and the number of FIBs

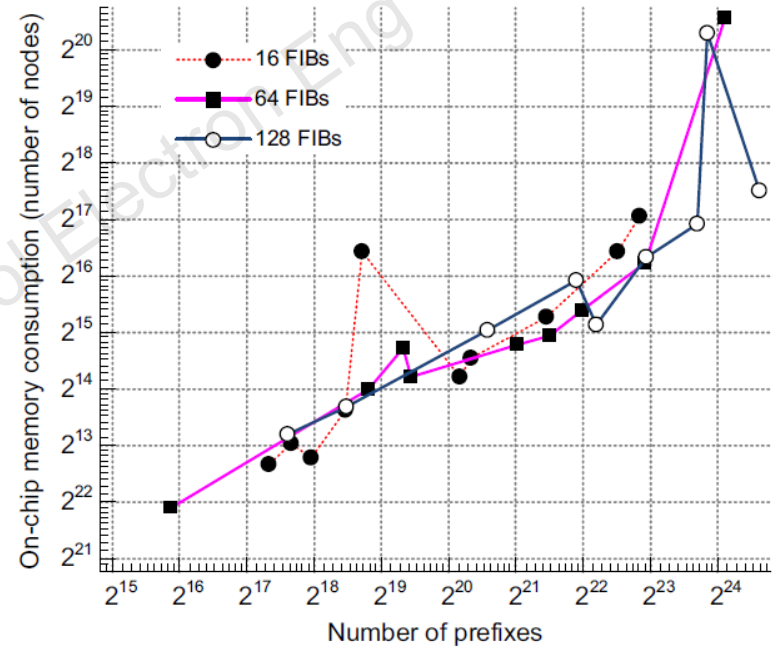


Fig. 4 The trend of on-chip memory varying with the number of FIBs (the split position is chosen as 18)

# Mechanism for fast rebuilding

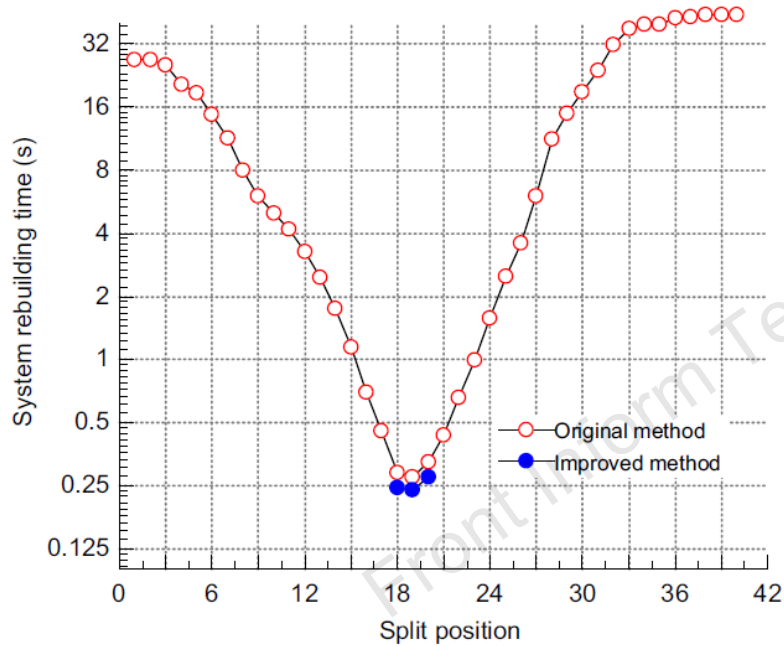


Fig. 6 Time efficiency of the two strategies of system rebuilding

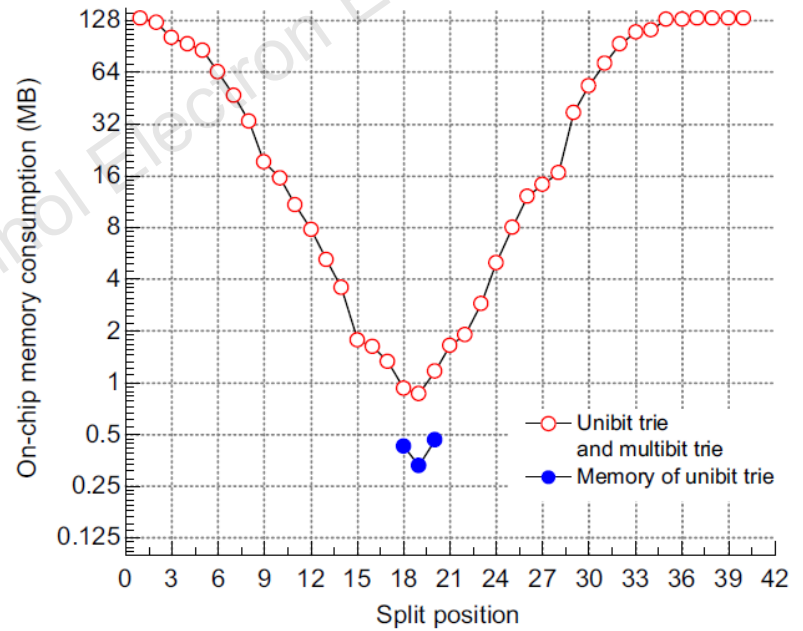


Fig. 7 Memory efficiency of the two strategies of system rebuilding

# Evaluation experiments

Table 1 Routing data set

Router	Location	Collected time	Collected number
Rrc00	RIPE NCC, Amsterdam	2001-04 to 2015-05	22
Rrc01	LINX, London	2001-10 to 2015-04	20
Rrc02	SFINX, Paris	2006-12 to 2008-10	3
Rrc03	AMS-IX, Amsterdam	2001-12 to 2015-05	22
Rrc04	CIXP, Geneva	2001-12 to 2015-05	21
Rrc05	VIX, Vienna	2002-12 to 2015-05	19
Rrc06	Otemachi, Japan	2001-12 to 2015-05	19
Rrc07	Stockholm, Sweden	2002-12 to 2015-05	21
Rrc08	San Jose (CA), USA	2002-12 to 2004-01	5
Rrc09	Zurich, Switzerland	2003-05 to 2004-01	5
Rrc10	Milan, Italy	2004-12 to 2015-04	17
Rrc11	New York (NY), USA	2004-12 to 2015-05	19
Rrc12	Frankfurt, Germany	2004-12 to 2015-05	20
Rrc13	Moscow, Russia	2005-12 to 2015-05	17
Rrc14	Palo Alto, USA	2006-10 to 2015-05	15
Rrc15	Sao Paulo, Brazil	2005-12 to 2015-05	15
Rrc16	Miami, USA	2006-12 to 2012-03	8

Total number of data sets collected: 272

Total number of prefixes collected: 89 122 790

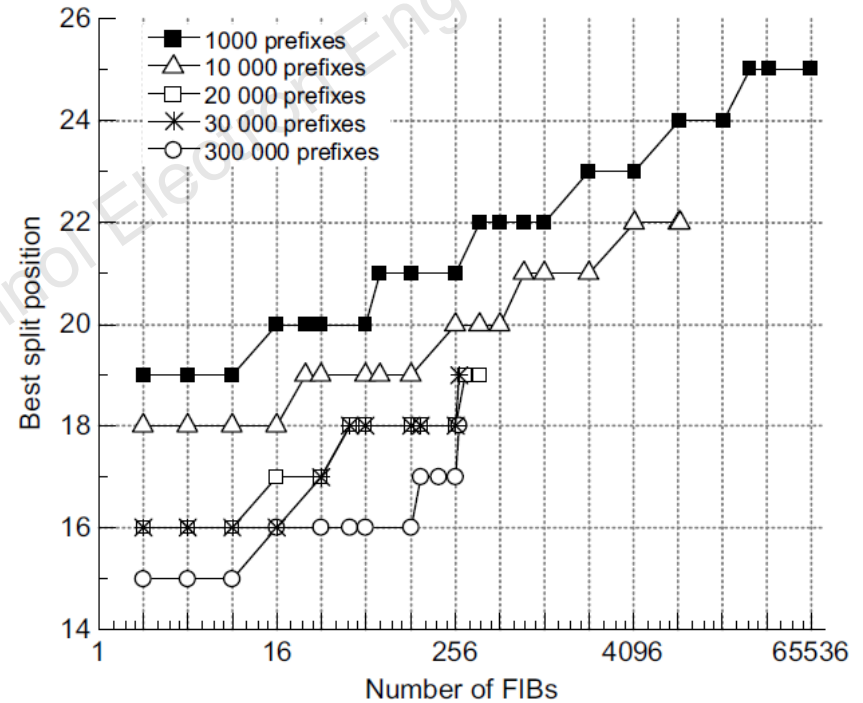


Fig. 8 The trends of the best split position

# Evaluation experiments

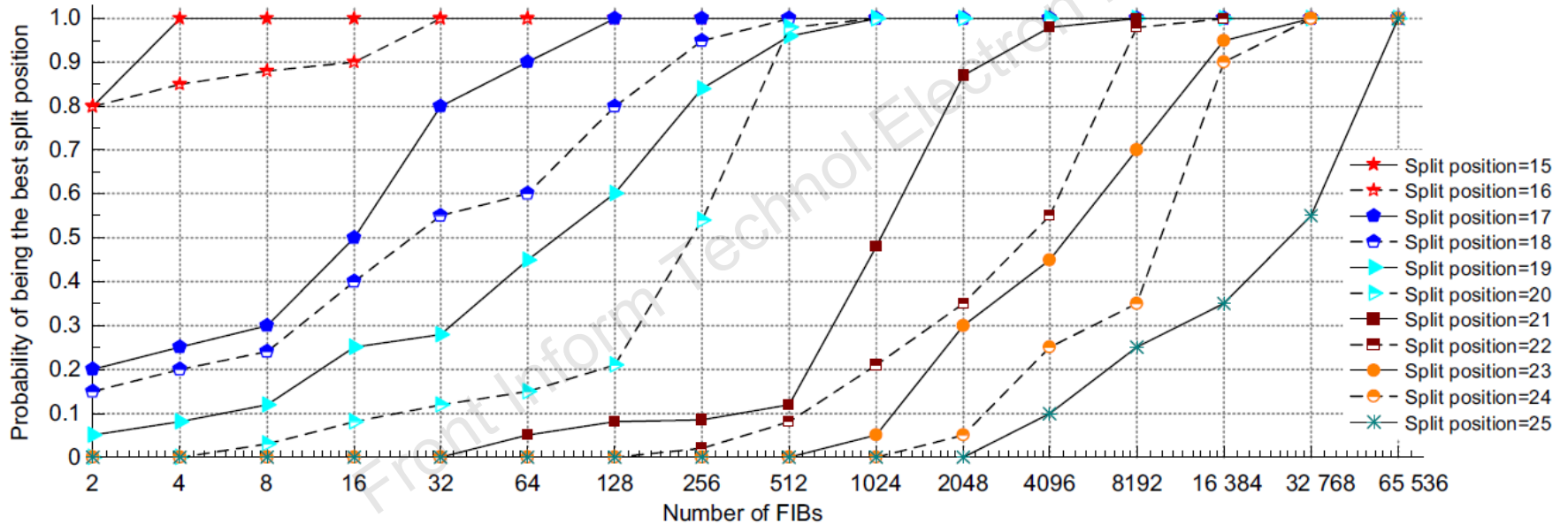


Fig. 9 The cumulative distribution of the ideal split position

# Evaluation experiments

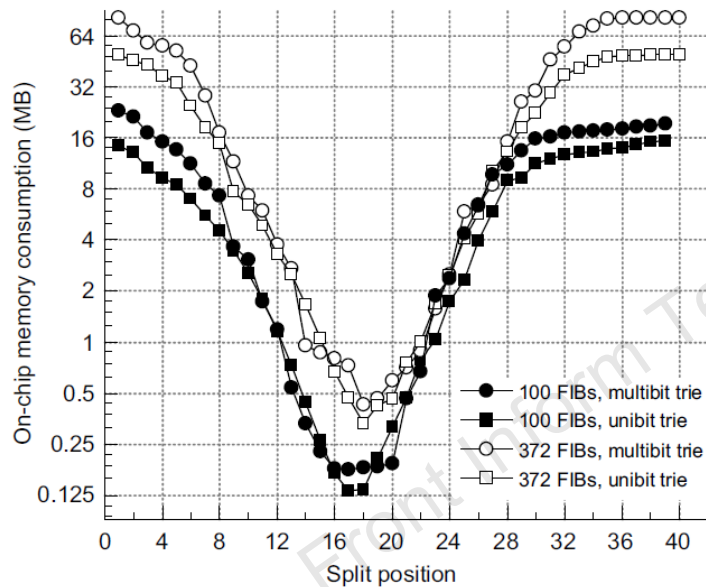


Fig. 10 The best split position of unibit and multibit tries

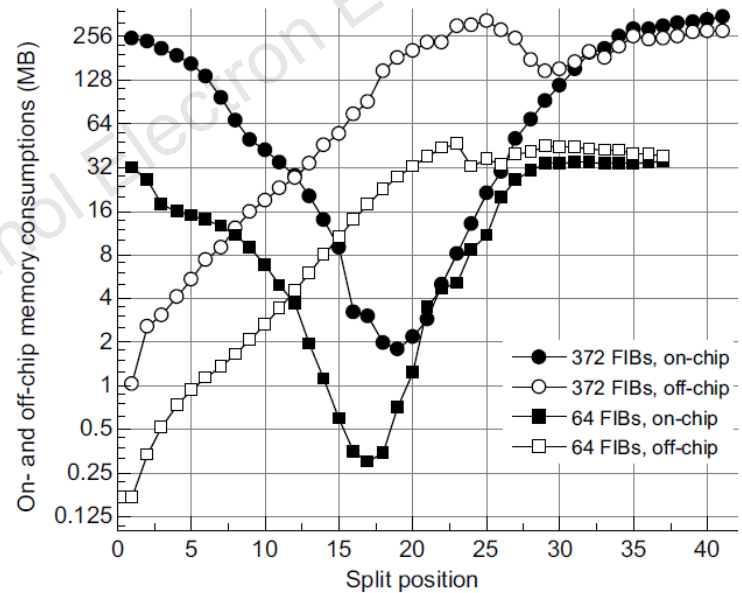


Fig. 11 On- and off-chip memory consumptions

# Conclusions

- We introduced an identity number to each prefix based on the number of FIBs and split the merged trie by using the splitting-after merging approach, which is memory efficient and supports fast update.
- The cumulative distribution of the ideal split position can help predict the best split position, which will shorten the detection time and accelerate the system rebuilding process