ACM SIGCOMM 2010 Session 6: Novel Implementations of Network Components

Viktor Puš

Brno University of Technology, Faculty of Information Technology
Božetechova 2, 612 00 Brno, CZ
ipus@fit.vutbr.cz

BRNO UNIVERSITY OF TECHNOLOGY
FACULTY OF INFORMATION TECHNOLOGY

evropský sociální fond v ČR
EVROPSKÁ UNIE
MINISTERSTVO ŠKOLSTVÍ, MLÁDEŽE A TĚLOVÝCHOVY
OP Vzdělávání pro konkurenceschopnost
INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

Obsah

- **SwitchBlade**
- **PacketShader**
- **EffiCuts**
- **vlastní poznámky**
- **zajímavé reference**

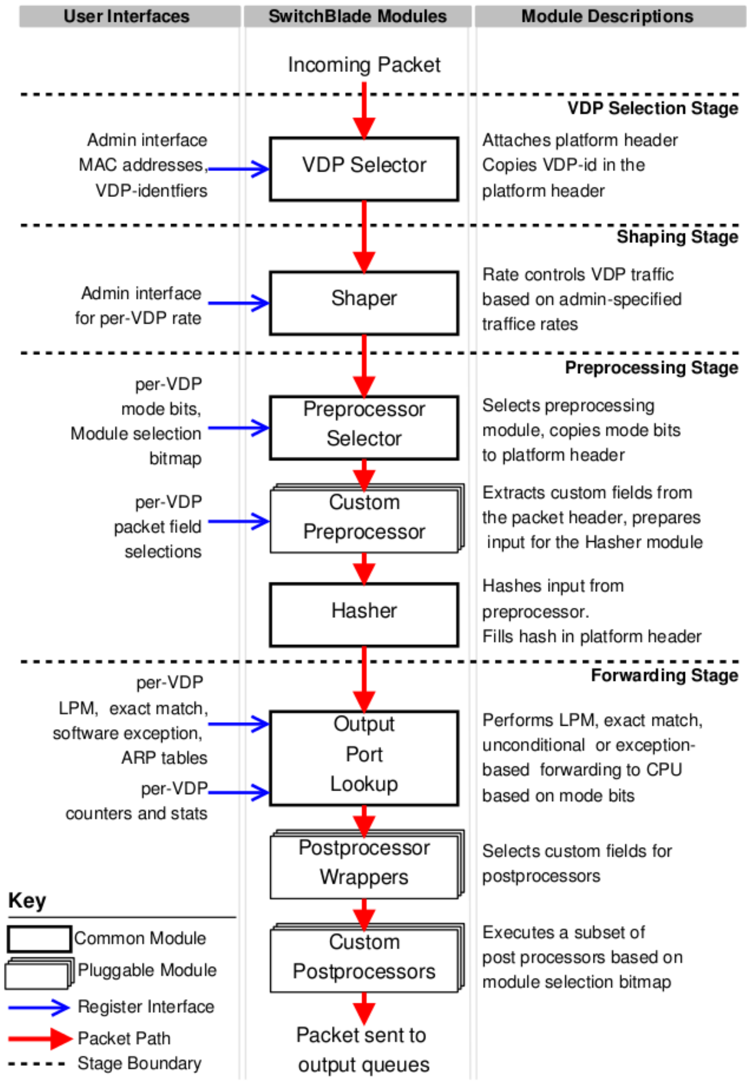
SwitchBlade - úvod

- „A platform for rapidly deploying custom protocols on programmable hardware“
- NetFPGA, wirespeed
- Cíle:
  - Rapid development and deployment on fast hardware
  - Customizability and programmability
  - Parallel custom data planes on a common hardware platform

SwitchBlade - návrh

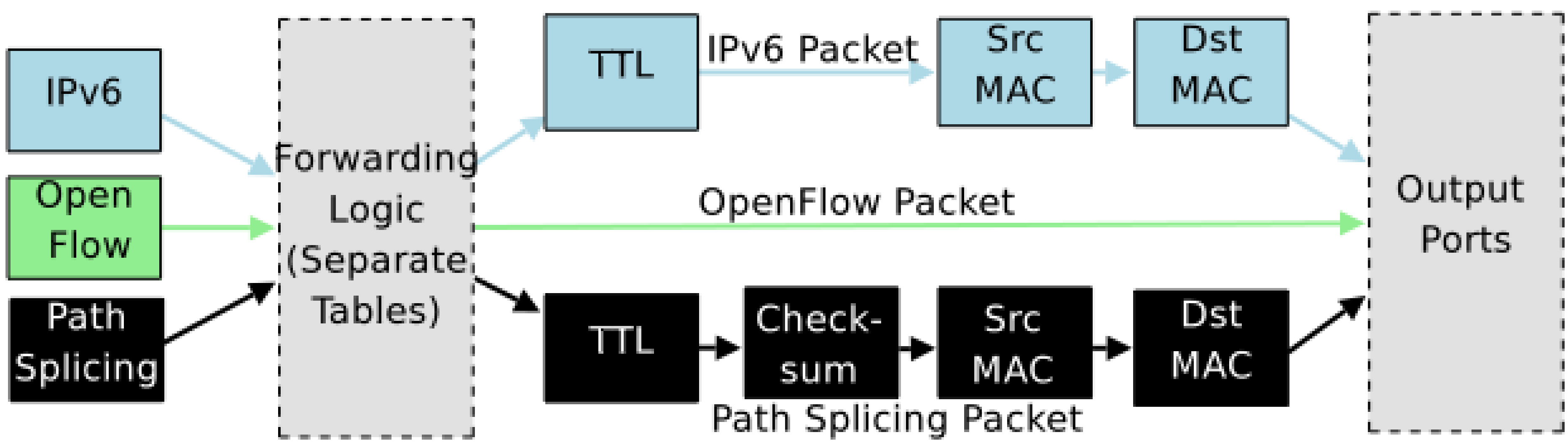
- Programovatelná pipeline
- Možnost vložení vlastních modulů

Field	Value	Description/Action
Mode	0	Default, Perform LPM on IPv4 destination address
	1	Perform exact matching on hash value
	2	Send packet to software for custom processing
	3	Lookup hash in software exceptions table
Module Selector Bitmap	1	Source MAC not updated
	2	Don't decrement TTL
	4	Don't Calculate Checksum
	8	Dest. MAC not updated
	16	Update IPv6 Hop Limit
	32	Use Custom Module 1
	64	Use Custom Module 2
	128	Use Custom Module 3



SwitchBlade - výsledky

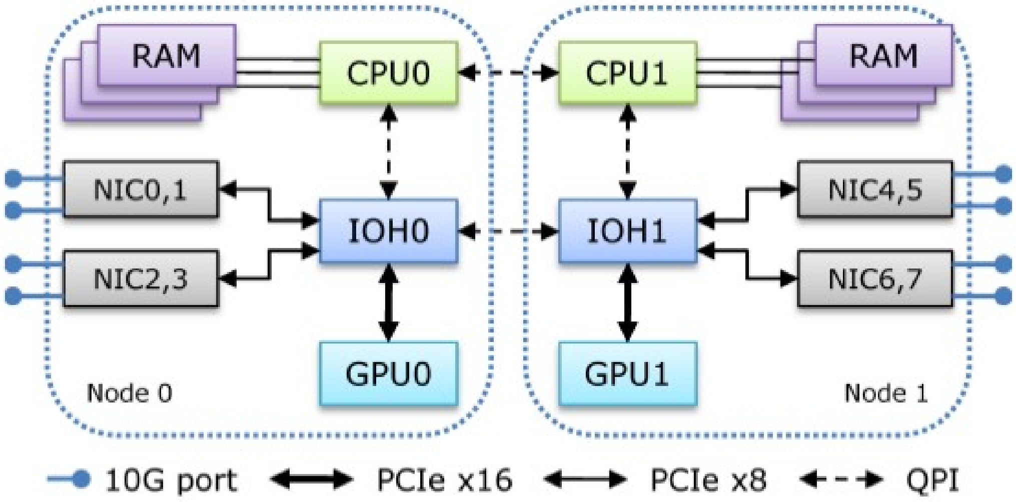
- Implementace ověřena na třech protokolech:
  - OpenFlow
  - IPv6
  - PathSplicing

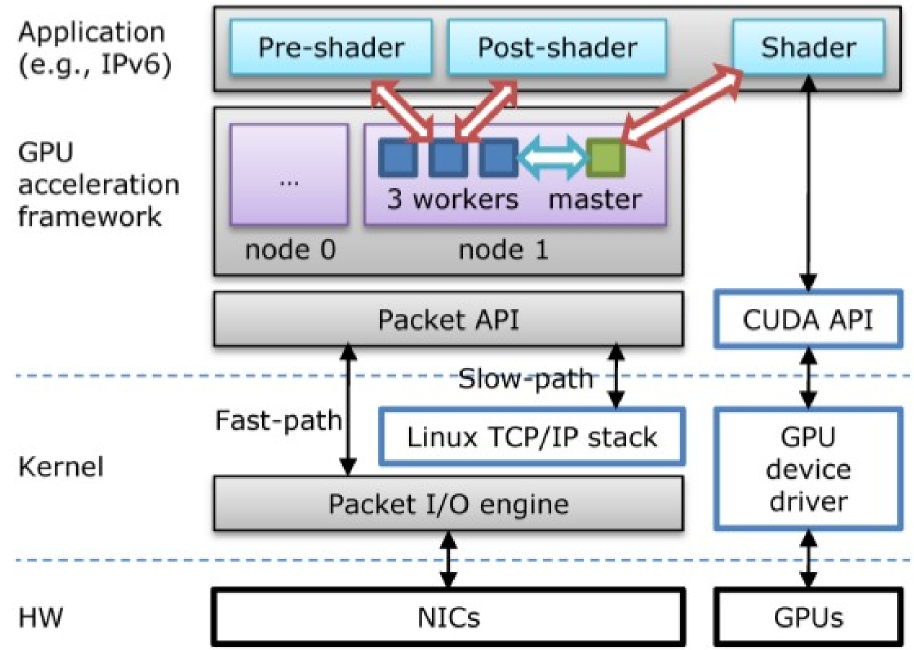


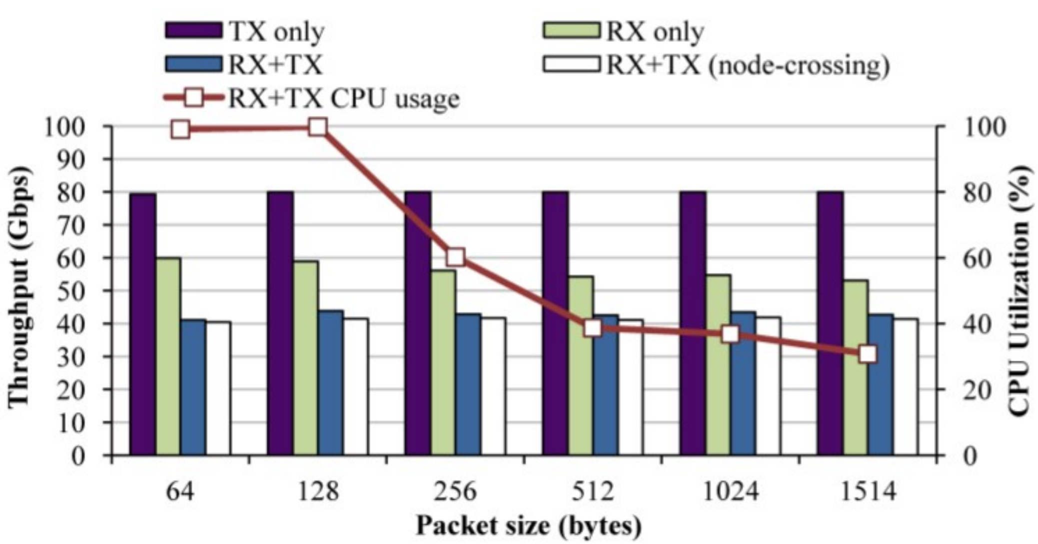
PacketShader - úvod

- Zpracování paketů na PC za $7000
  - 2 x NVIDIA GTX480
  - 2 x Intel Xeon X5550
- Aplikace: IPv4 a IPv6 forwarding, OpenFlow switching, Ipsec tunneling
- Výsledky: 39 Gbps na 64B IPv4 paketech

PacketShader - architektura







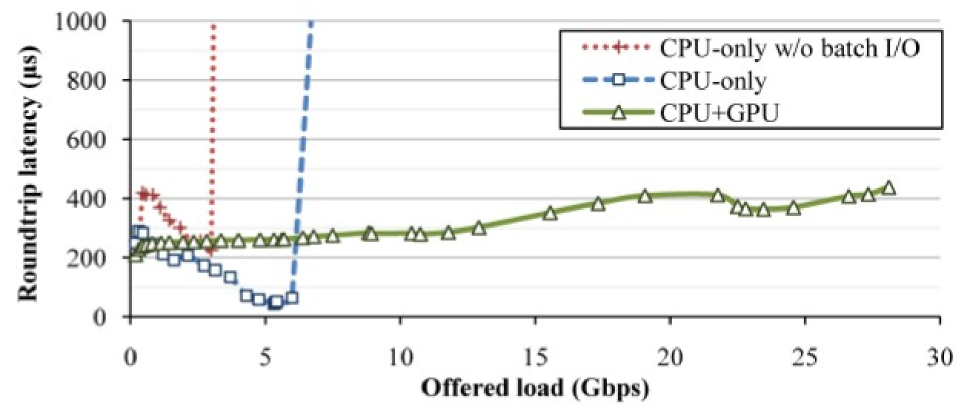
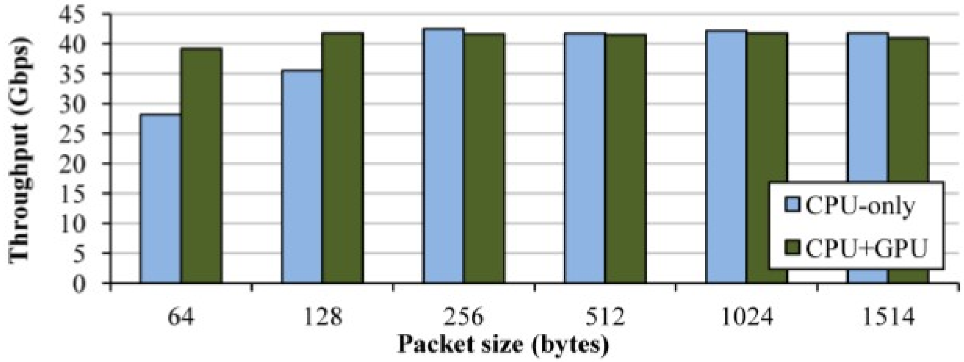
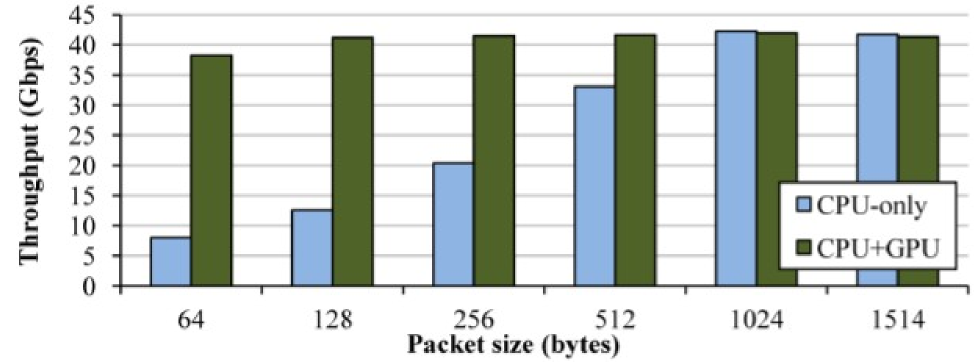


Figure 12: Average roundtrip latency for IPv6 forwarding

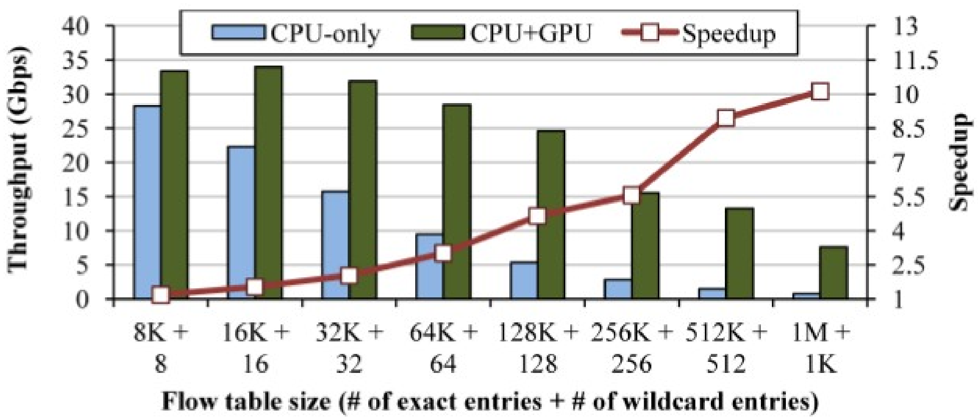
PacketShader - výsledky



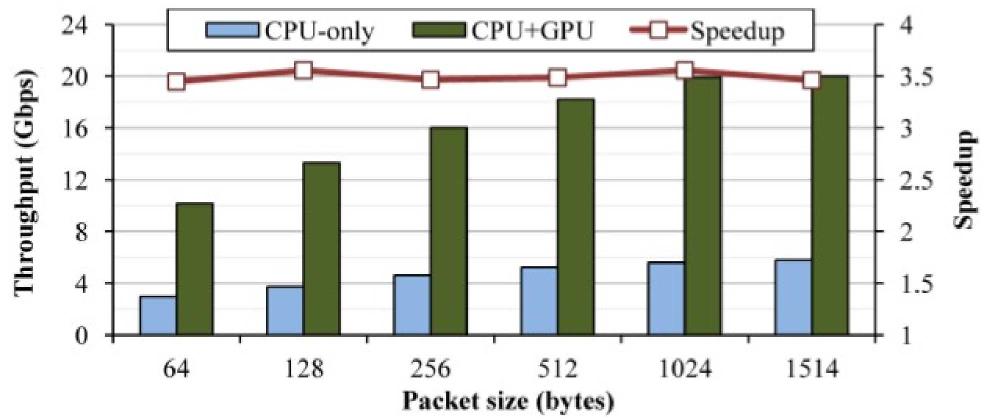
(a) IPv4 forwarding



(b) IPv6 forwarding



(c) OpenFlow switch (with 64B packets)



(d) IPsec gateway

EffiCuts - úvod

- Klasifikační algoritmus, zlepšení HyperCuts
- 4 zlepšení:
  - Separable trees
  - Selective tree merging
  - Equi-dense cuts
  - Node Co-location

EffiCuts – Separable trees

- HiCuts i HyperCuts dělí prostor na stejné části
- Je-li pravidlo ve více částech, je replikováno
    - (i 10 000x)
- Rozdělení pravidel na „velká“ a „malá“ v jednotlivých dimenzích

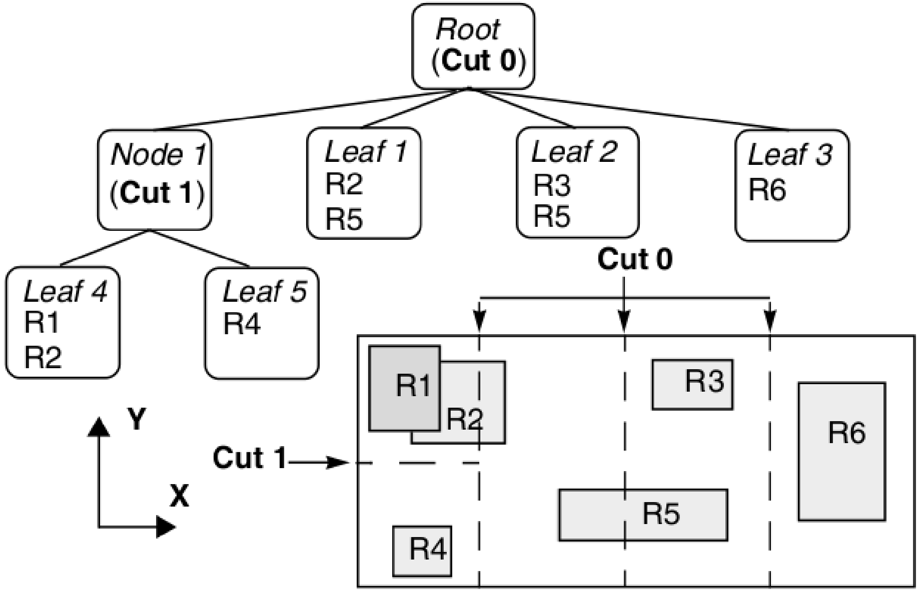


FIGURE 1. HiCuts Example in a 2D Rule Space

EffiCuts – Selective tree merging

- Až 26 kategorií pravidel → stromů
  - V praxi do 15
- Hloubka stromu vzniklého sloučením je většinou menší než součet hloubek
- Ale je větší šance replikace pravidel
- Heuristika

EffiCuts – Equi-dense cuts

- Prostor se dělí tak, aby části obsahovaly stejný počet pravidel
  - Ne aby byly stejně velké

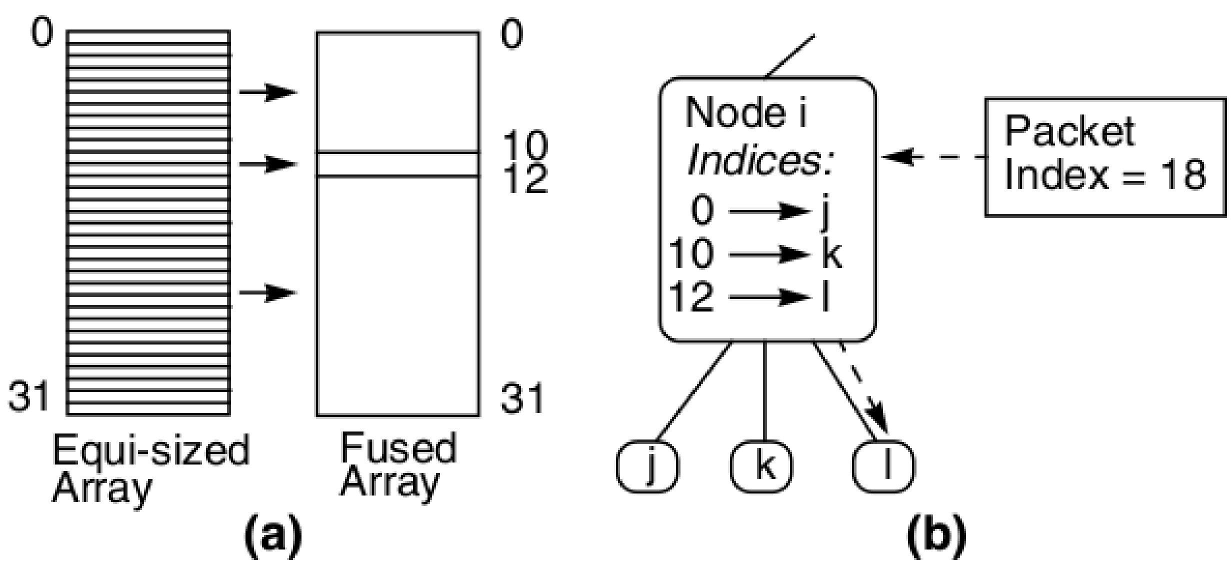


FIGURE 4. Equi-dense Cuts: (a) Fusion (b) Lookup

EffiCuts – Node co-location

- Dříve: Na základě hlavičky se vyčetl ukazatel, a tam se skočilo
- Nyní: S ukazatelem se rovnou vyčte hlavička, ta určí offset od ukazatele
  - Uzly jsou uloženy za sebou jako u TreeBitmap

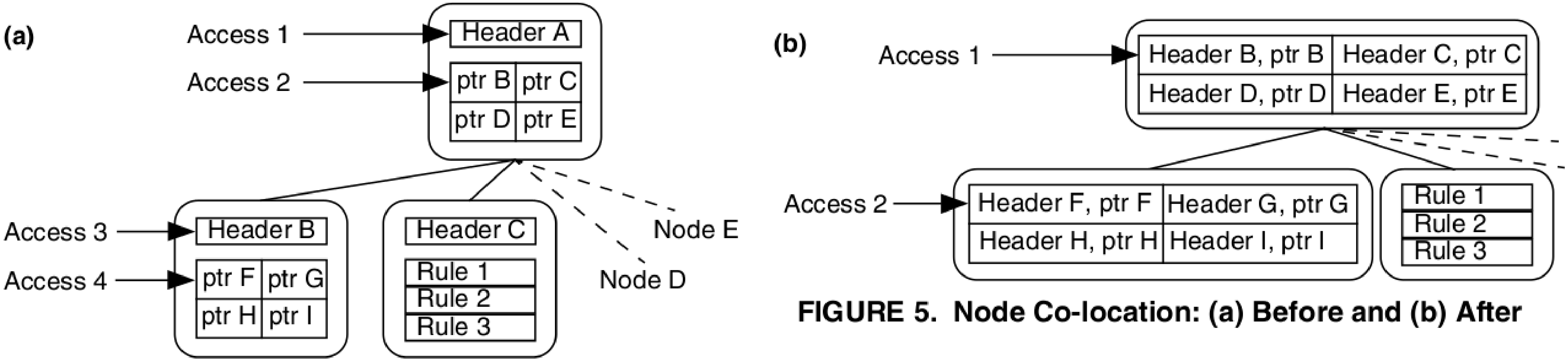
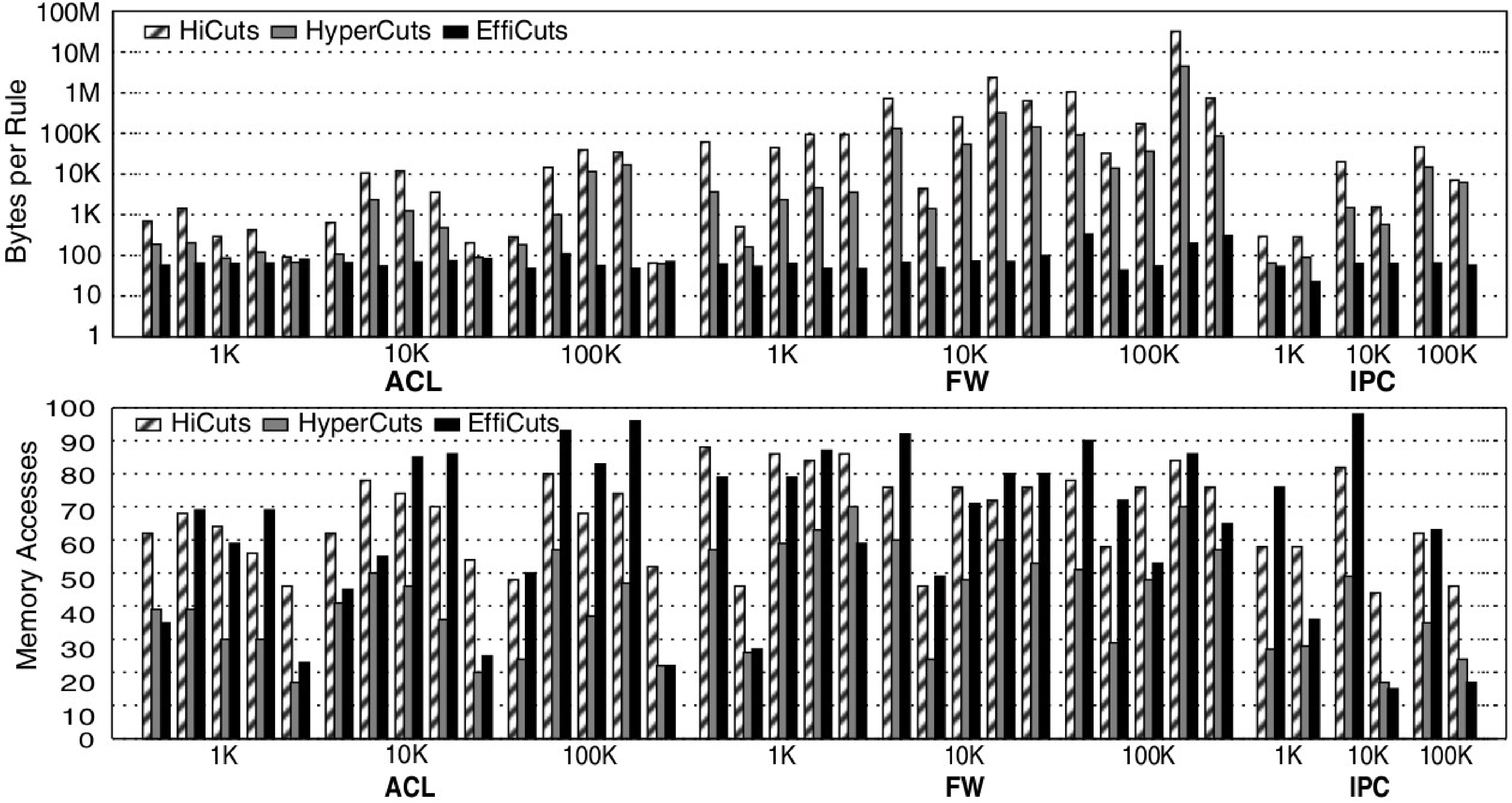


FIGURE 5. Node Co-location: (a) Before and (b) After

EffiCuts – výsledky 1



EffiCuts – výsledky 2

Table 3: Typical Power and Throughput Comparison

Classifier Type	TCAM			HyperCuts						EffiCuts					
	Cycle time (ns)	Energy (nJ)	Power (W)	# Memory accesses	Size (MB)	Cycle time (ns)	Energy (nJ)	# Copies	Power (W)	# Memory accesses	Size (MB)	Cycle time (ns)	Energy (nJ)	# Copies	Power (W)
ACL 100K	7.46	169.5	23	37	1084	0.18	5.6	1	31	83	5.3	0.18	0.51	2	6
FW 100K	7.46	169.5	23	48	2433	0.21	8.3	2	81	53	3.7	0.20	0.43	2	4
IPC 100K	7.46	169.5	23	24	575	0.17	4.3	1	26	17	5.5	0.18	0.51	1	3

Zajímavé reference

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Diskuze