



MikroTik

Router Architecture Evolution

Presented by:





@mikrotik.indonesia



Mikrotik Indonesia

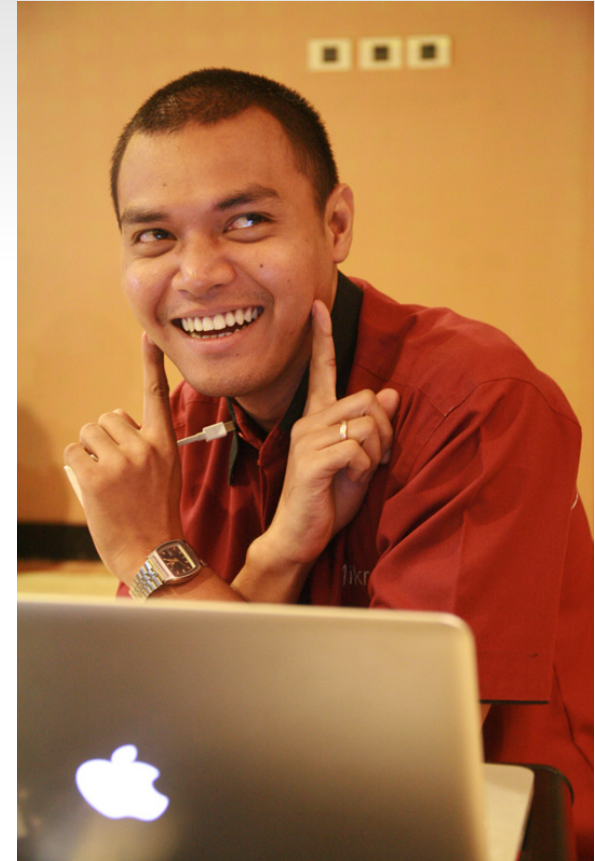


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- Work for Citraweb / Citranet
 - Mikrotik Distributor & Training Center
 - ISP
 - Mikrobits Principal
- Product & Technical Director
- Mikrotik Certified Trainer
- MTCNA, MTCTCE, MTCRE, MTCWE, MTCUME, MTCINE, MTCIPv6e





Router Architecture ?????



Router ??

- Apakah Router sebuah komputer ?
- Router menggunakan komponen apa saja ?
- Apakah Router memerlukan spesifikasi yang tinggi ?
- Router yang seperti apa yang paling ideal?

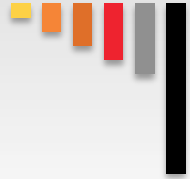


First Router !!!
ARPANET (DARPA)

Honeywell DDP-516

16bit Minicomputer
2.5 – 5MHz Processor

54KG – 475Watt
(1969 – 1989)

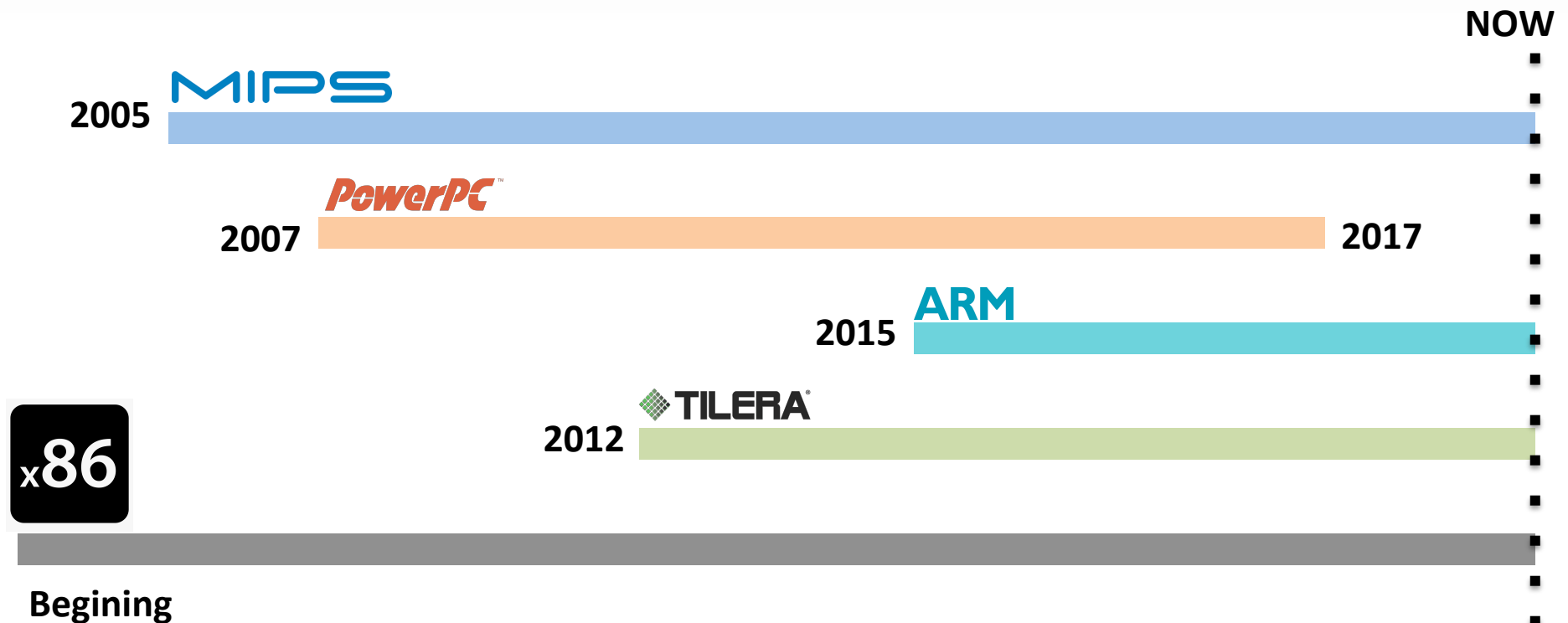


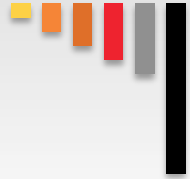
Router Architecture

- Router adalah sebuah “networking device”
 - Passing traffic by routing decision
- Saat ini Router menjelma menjadi “multi purpose device”
 - Monitoring, server, bandwidth limiter, firewall, iot dll
- Semakin banyak fungsi yang dibutuhkan, semakin menuntut kinerja router terutama dari processor yang tertempel di router.
- Mikrotik menggunakan beberapa CPU Architecture yang berbeda untuk bisa mengakomodasi kebutuhan berbagai macam fungsi yang ada di RouterOS.



RouterBoard TIMELINE



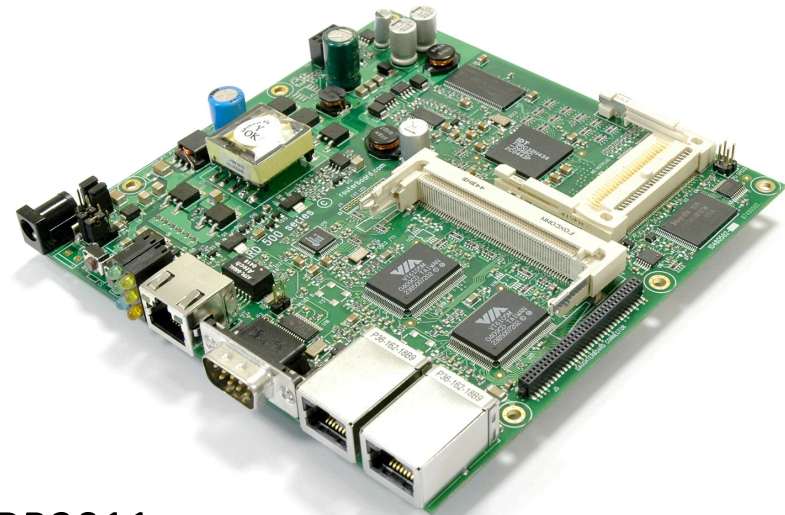


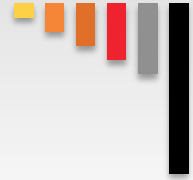
MIPS Architecture

Introduced	1981
Design Architecture	RISC
Instruction Set	32bit/64bit
Multicore support	Yes
Core	1 Core – 4 Core
Clock Speed	233MHz - 680MHz
Cache Memory	16KB - 64KB L1 Cache 64-256KB L2 Cache
Power Consumption	4W – 10W

- First Product : RB532
- Current Active Product : hAP, hEX, LHG, RB2011
- Mikrotik Package :
 - MIPSLE(deprecated)/MIPSBE/SMIPS/MMIPS

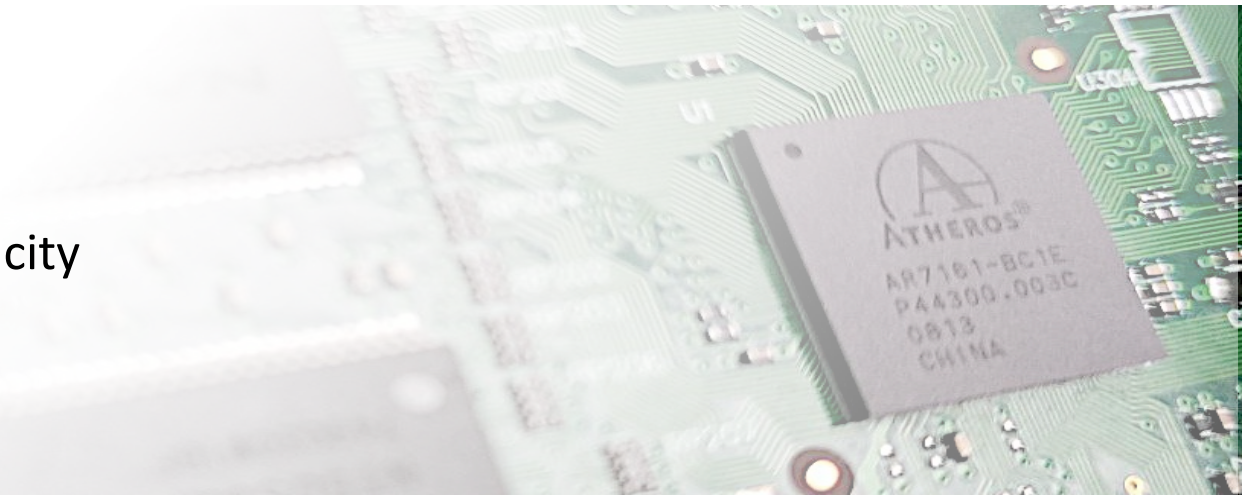
RB532

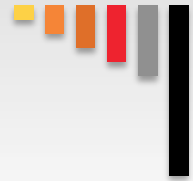




MIPS Key Features

- “MIPS (**Microprocessor without Interlocked Pipelined Stages**), *simple and robust design ensures reliable non-stop operation*”
- Pros :
 - Low Cost 😊
 - Power-efficient
 - Compact Size
 - Simple Design
- Cons :
 - Low Interrupt capacity
 - Low Clock Speed





PPC Architecture

Introduced	1990
Design Architecture	RISC
Instruction Set	32bit/64bit
Multicore support	Yes
Core	1 Core – 30 Core
Clock Speed	333MHZ - 4000MHz
Cache Memory	16KB - 48KB L1 Cache 64KB – 4MB L2 Cache 18MB – L3 Cache
Power Consumption	4W – 25W

- First Product : RB333
- Current Active Product : -
- Last Product : RB1100AHx2
- Mikrotik Package :

– PPC

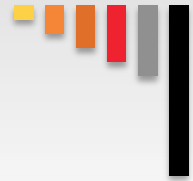




PowerPC Features

- “developed by **IBM-APPLE-MOTOROLA** in early stages for PC. **Freescall** continue the project primary use in system-on-a-chip (SoC) designs with speed ranging up to 1066 MHz, thus making them ideal for embedded applications”
- Pros:
 - Simple design
 - Bigger interrupt capacity
 - Power efficient
 - Higher FPU (Floating Point Unit)
- Cons:
 - Complex code density





TILERA Architecture

Introduced	2004
Design Architecture	RISC
Instruction Set	64bit
Multicore support	Yes
Core	9Core – 100Core
Clock Speed	600MHz - 1200MHz
Cache Memory	32KB L1 Cache Per Core 256KB L2 Cache Per Core 18MB L3 Cache
Power Consumption	10W - 65W

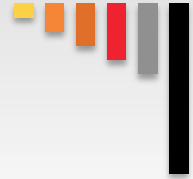


CCR1072

- First Product : CCR1016
- Current Active Product : CloudCoreRouter series
- Mikrotik Package :

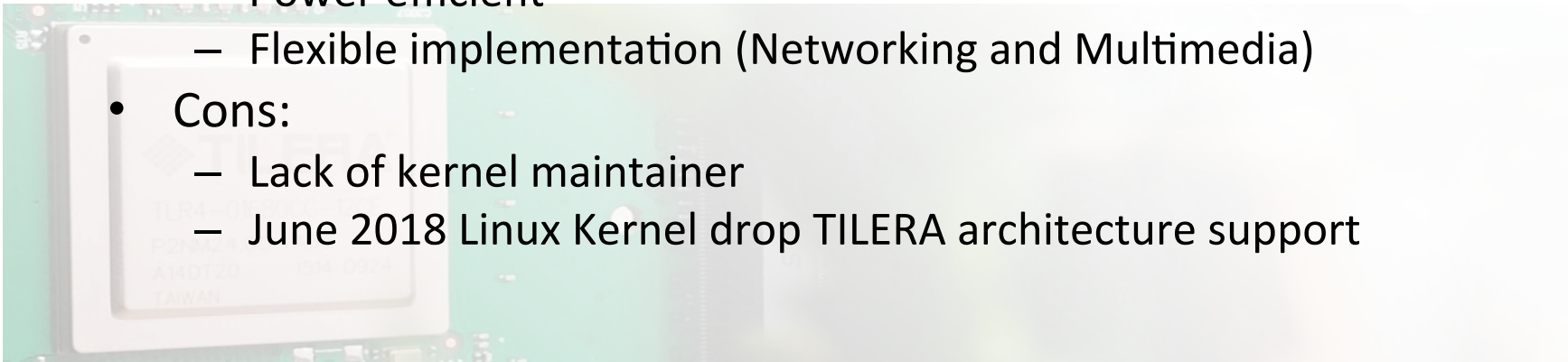
– Tile





TILERA Features

- “developed by **MIT** since 1990. First processor released in 2007 with 64Core-TILE64. **Mikrotik** is the first Manufacturer to ship devices using this processor. Right now TILERA acquired by NVIDIA”
- Pros:
 - Individual core combined in mesh (iMesh design)
 - Scalable Lot of core
 - Power efficient
 - Flexible implementation (Networking and Multimedia)
- Cons:
 - Lack of kernel maintainer
 - June 2018 Linux Kernel drop TILERA architecture support



TILERA Implementation

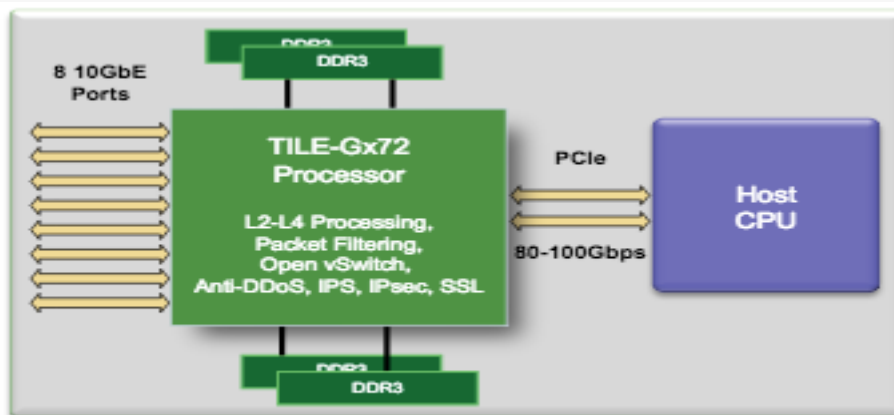


Figure 2. High I/O "Front End" Application Processor

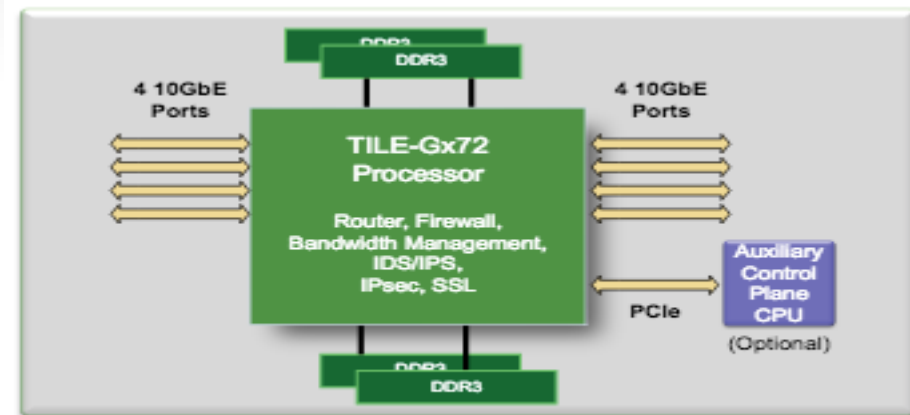
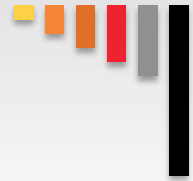


Figure 3. 40Gbps In-Line Dataplane Processor





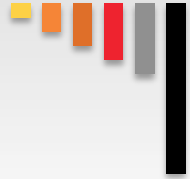
ARM Architecture

Introduced	1985
Design Architecture	RISC
Instruction Set	32bit/64bit
Multicore support	Yes
Core	1 Core - 128 Core
Clock Speed	700MHz - 3GHz
Cache Memory	16KB - 64KB L1 Cache 64-1MB L2 Cache

Power Consumption 4W – 250W

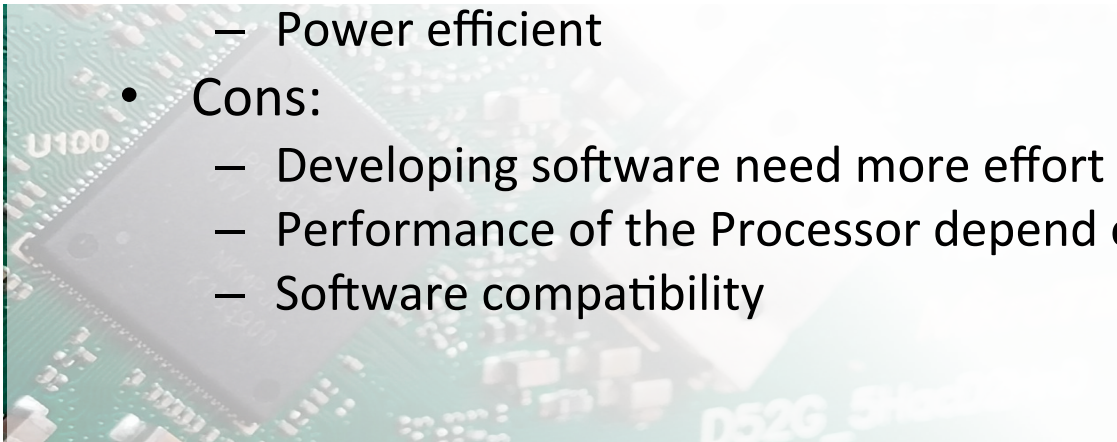
- First Product : RB3011
- Current Active Product : RB3011, RB1100AHx4, CCR2004, Audience, RB450Gx4 etc..
- Mikrotik Package :
 - ARM, ARM64





ARM Features

- “(Advanced RISC Machines) **ARM** processor become the mainstream of consumer electronic devices right now. It is because ARM has balanced performance and power efficiency ”
- Pros:
 - Ideal for embedded and mobile devices
 - Flexible to develop / design your own processor
 - Power efficient
- Cons:
 - Developing software need more effort
 - Performance of the Processor depend on the software
 - Software compatibility





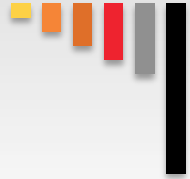
X86 Architecture

Introduced	1978
Design Architecture	CISC
Instruction Set	32/64
Multicore support	Yes
Core	2 Core - 64 Core
Clock Speed	1000MHz - 4GHz
Cache Memory	64KB L1 Cache / Core 6MB L2 Cache 64MB L3 Cache
Power Consumption	10W – 255W

- First Product : RB230
- Current Active Product : -
- Mikrotik Package :



– x86



X86 Features

- “x86 is one of the oldest microprocessor architecture, Intel and AMD really serious to developing this architectures”
- Pros:
 - Fast development and lot of kernel maintainer
 - Multi purpose
 - Easy upgrade and maintenance
- Cons:
 - Power hungry
 - License of the architecture for developing your own processor.
(x86 – Intel, x86-64 – AMD)
 - expensive



RISC

Reduced Instruction
Set Computers

MIPS
TECHNOLOGIES

*PowerPC*TM

ARM

 TILERA[®]

VS

CISC

Complex Instruction
Set Computers

intel[®]


AMD



RISC vs CISC

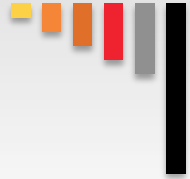
- **RISC**

- Emphasis on hardware
- Includes multi-clock complex instructions
- Small code sizes, high cycles per second
- Transistors used for storing complex instructions

- **CISC**

- Emphasis on software
- Single-clock, reduced instruction only
- Low cycles per second, large code sizes
- Spends more transistors on memory registers

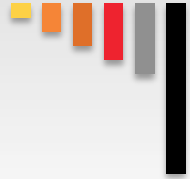




Mikrotik Product (RouterBoard)

- Mikrotik menggunakan hampir semua architecture yang ada sekarang untuk mengadopsi fungsi-fungsi yang ada di RouterOS yang makin lama semakin banyak.
 - MIPS – 113 type
 - PPC – 0 type
 - ARM – 48 type
 - TILERA – 10 type
 - X86 – masih dimaintain sebagai software package
- Terdapat pergantian architecture pada satu seri.
 - RB1100AH series, RB450 series

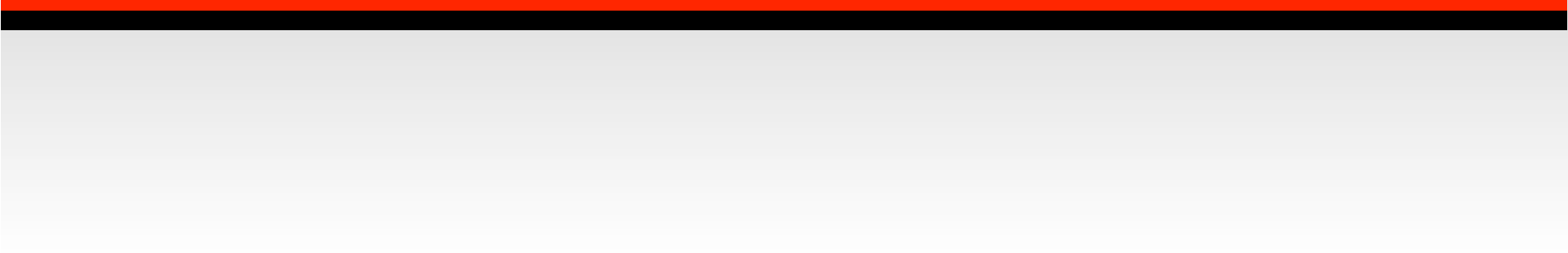




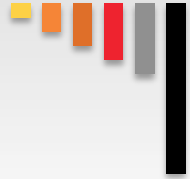
Kenapa ?

Terdapat berbagai alasan kenapa Mikrotik menggunakan beberapa architecture pada produk hardware nya:

- Sesuai dengan kebutuhan implementasi perangkat
- Perkembangan teknologi dan fitur yang ada di RouterOS
- Harga menjadi pertimbangan paling penting
- Teknologi processor terkadang sudah ketinggalan jaman



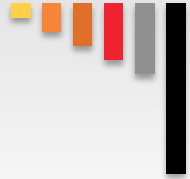
Clock Speed VS Multi Core



Clock Speed VS Multi Core

- Which one do you need ?
- RouterOS v7 - List of tasks that can be split in Multicore:
 - Handling of "print" command
 - Entire OSPF protocol handling
 - Entire RIP protocol handling
 - Static configuration handling
 - Routing Policy configuration
 - BGP connections and configuration handling
 - BGP receive (one task per peer or grouped by specific parameters)
 - BGP send (one task per peer or grouped by specific parameters)
 - FIB update.

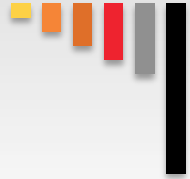




Clock Speed VS Multi Core

- “Packet filtering itself is hard to make take advantage of parallel execution because of stateful filtering and because the traffic has to be processed in order”
- “heavy operations based on per-connection processing need single-core performance, ex. Queue”
- Tidak semua fitur pada router bisa memanfaatkan multicore !

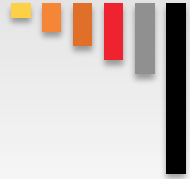




Kesimpulan

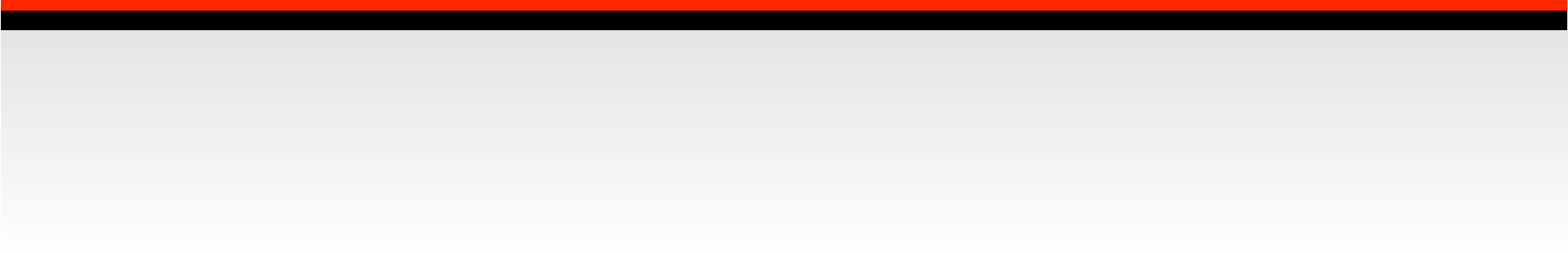
- Router Mikrotik berkembang seiring mengikuti perkembangan teknologi komputasi.
- Performance Router secara keseluruhan dipengaruhi dari hardware yang digunakan, tetapi tetap harus didukung oleh software yang mampu menunjang seluruh potensial dari hardware tersebut.
- Setiap Architecture processor memiliki keunggulan dan kelemahan masing-masing





Kesimpulan

- Processor paling ideal untuk semua kebutuhan masih belum ditemukan sampai saat ini.
- Gunakan Architecture yang optimal sesuai dengan kebutuhan.



Pertanyaan ?????

Terima kasih kepada :



citranet

Terima Kasih



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