



*Mikro***Tik**

Router Architecture Evolution

Presented by:





CITRAWEB
SOLUSI TEKNOLOGI



@mikrotik.indonesia



Mikrotik Indonesia



@mikrotik_id

Novan Chris

novan@mikrotik.co.id

- Work for Citraweb / Citranet
 - Mikrotik Distributor & Training Center
 - ISP
 - Mikrobites 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)

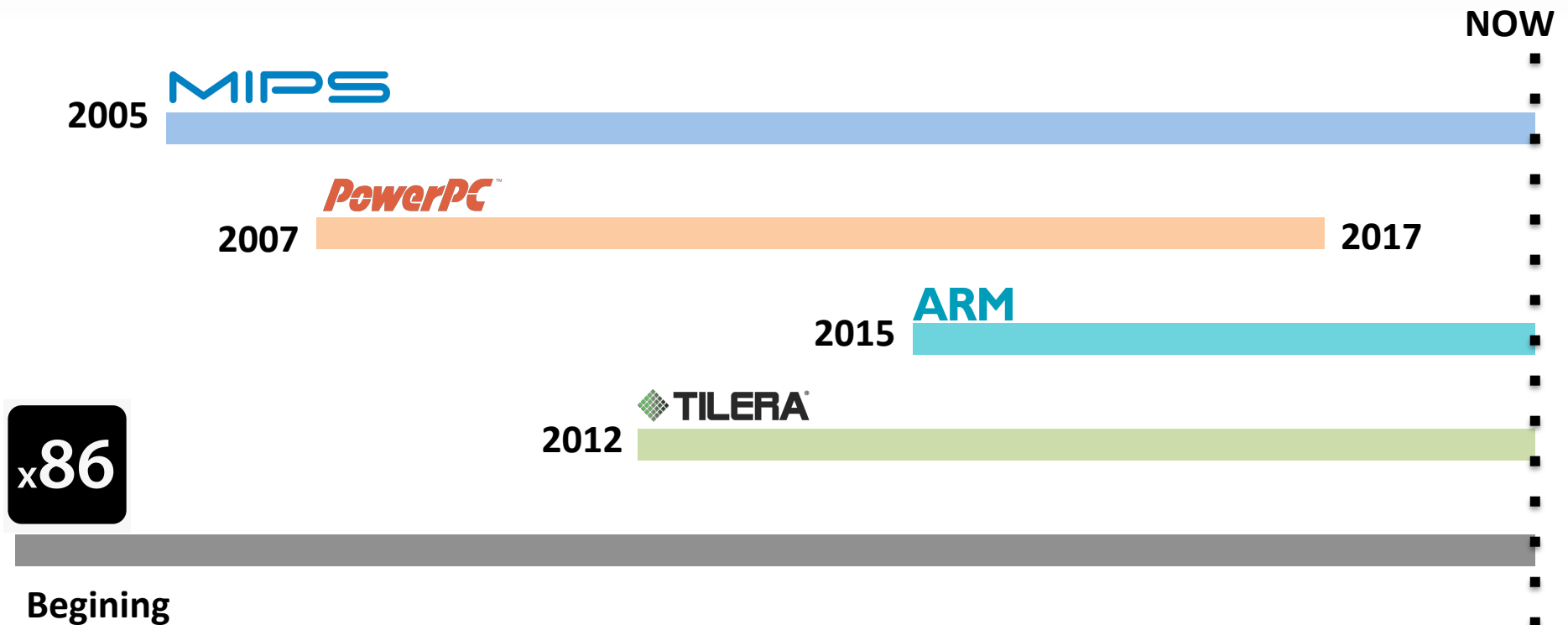


Router Architecture

- 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



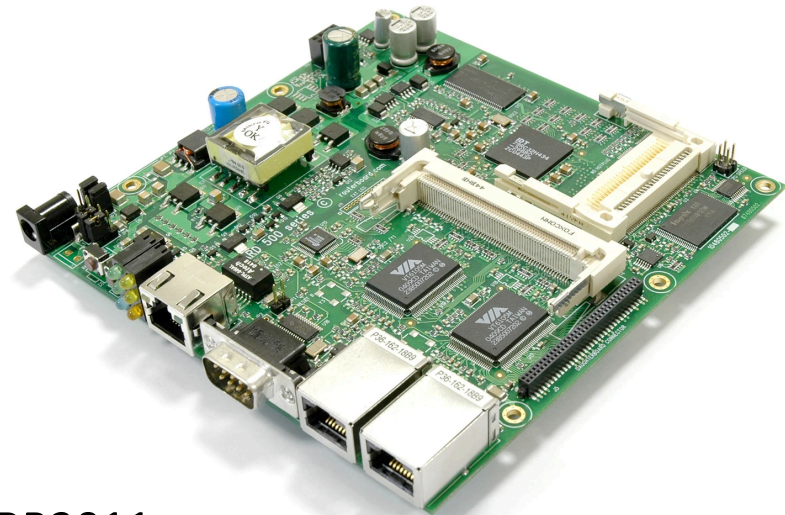


MIPS Architecture

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

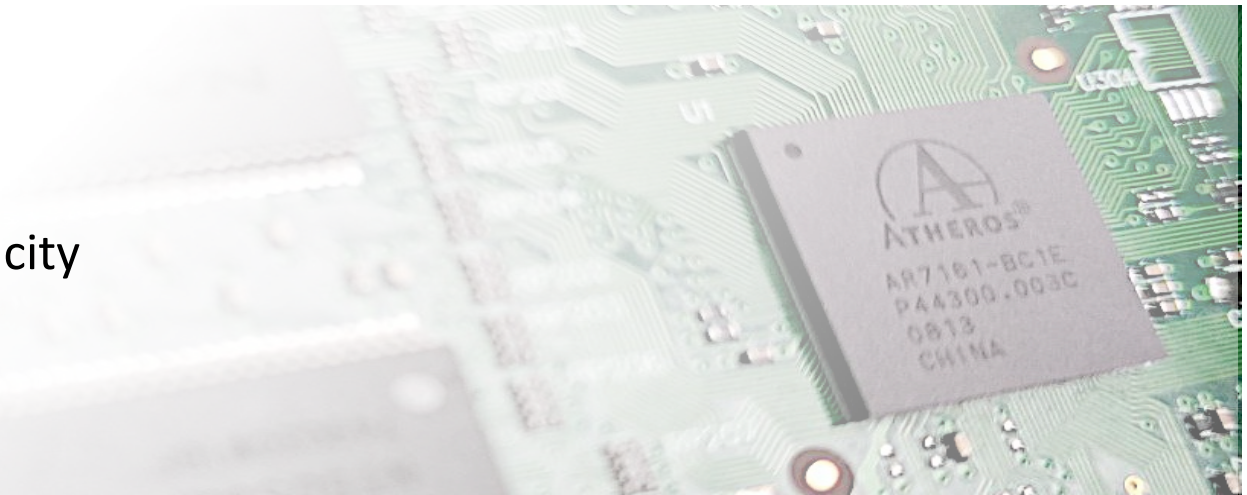
RB532

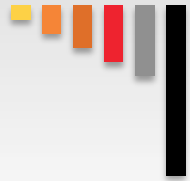




MIPS Key Features

- “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. **Freescale** 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

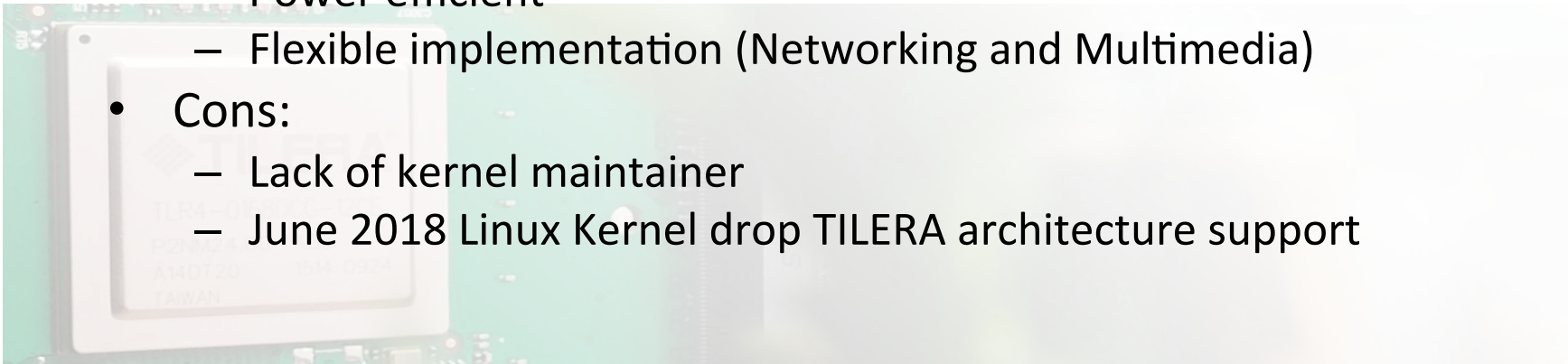
- First Product : CCR1016
- Current Active Product : CloudCoreRouter series
- Mikrotik Package :
 - Tile

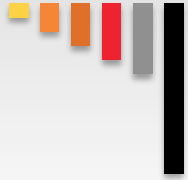




TILERA Features

- “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

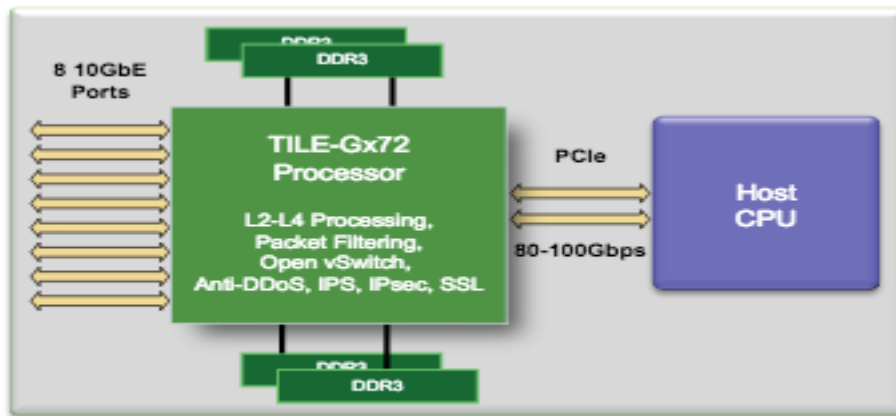


Figure 2. High I/O "Front End" Application Processor

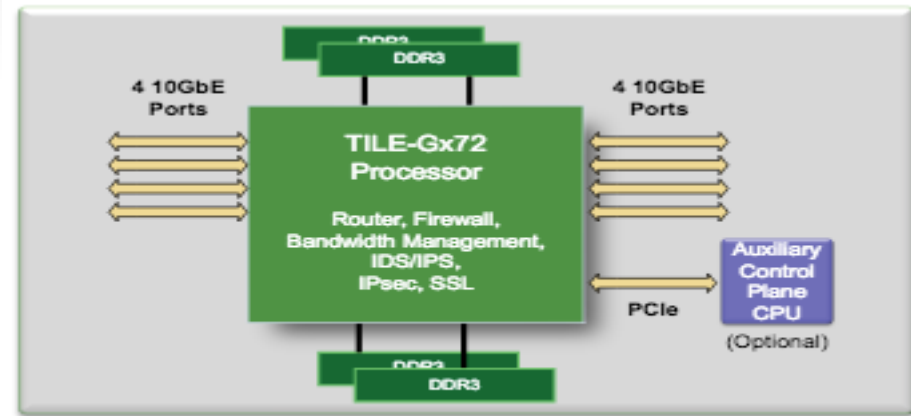


Figure 3. 40Gbps In-Line Dataplane Processor





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

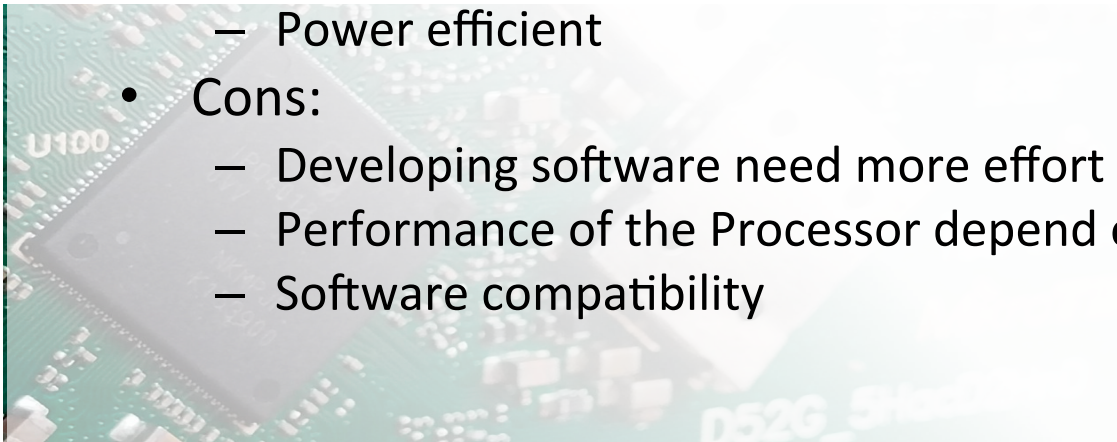
- First Product : RB3011
- Current Active Product : RB3011, RB1100AHx4, CCR2004, Audience, RB450Gx4 etc..
- Mikrotik Package :
 - ARM, ARM64

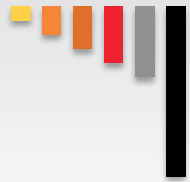




ARM Features

- “(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





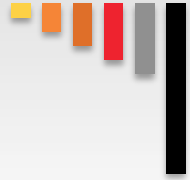
X86 Architecture

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™

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

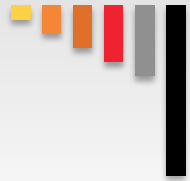




Mikrotik Product (RouterBoard)

- 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





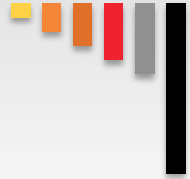
Kenapa ?

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.

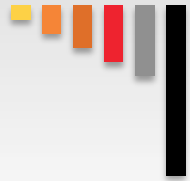




Clock Speed VS Multi Core

- “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



Kritik dan Saran :



info@mikrotik.co.id



[@mikrotik_id](https://twitter.com/mikrotik_id)



[Mikrotik Indonesia](https://www.youtube.com/MikrotikIndonesia)



[@mikrotik.indonesia](https://www.instagram.com/mikrotik.indonesia)

This license lets others remix, tweak, and build upon your work even for commercial purposes, as long as they credit you and license their new creations under the identical terms. This license is often compared to “copyleft” free and open source software licenses. All new works based on yours will carry the same license, so any derivatives will also allow commercial use.