

# Ramon Chips

## RC64

## Rad-hard high-performance DSP manycore



Ramon Chips is named in memory of Col. Ilan Ramon, Israeli astronaut who died on board the Columbia space shuttle, 1/2/2003

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Prof. Ran Ginosar, CEO, [ran@ramon-chips.com](mailto:ran@ramon-chips.com)

# Ramon Chips

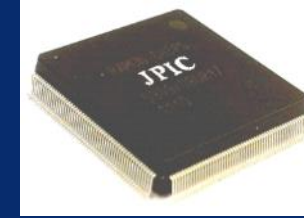
Space chips and systems company. ITAR-FREE products. Government funded since 2004

25-strong team with diverse extensive experience  
in computing, communications, semiconductors, software and space



# Space Heritage: JPIC

- Image compression chip
- Advanced low-cost technology
  - Plastic packaged, rad-hard, hi-rel
  - Space-qualified to RC own **RC1** flow
- 24 units on Ofeq-11 (IL)
- 24 units on OPSAT-3000 (IT)



# Space Heritage: GR712RC LEON3FT x2

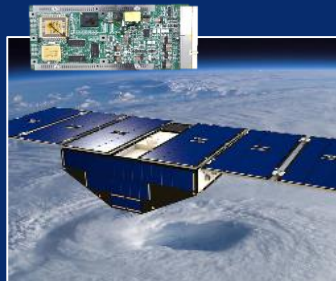
## IN SPACE



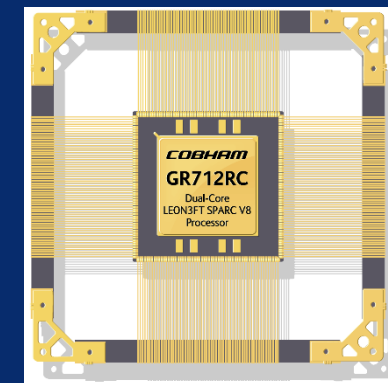
JAXA / DLR  
HAYABUSA 2



ESA  
EXOMARS TGO



NASA  
CYGNSS  
8x constellation



Rad-hard dual-core  
LEON3FT processor SOC  
Qualified to MIL-STD-883  
/ MIL-PRF-38535 Class S

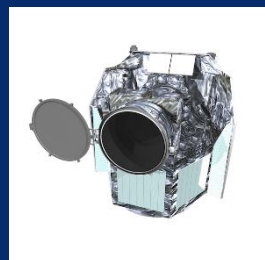
## FUTURE MISSIONS



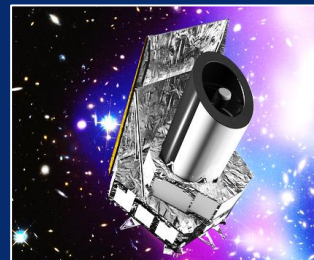
ESA  
JUICE



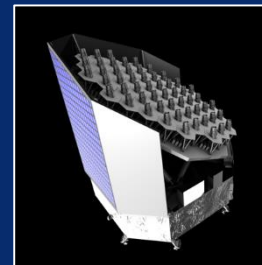
ESA  
SOLAR ORBITER



ESA  
CHEOPS



ESA  
EUCLID



ESA  
PLATO

Marketed, sold and supported exclusively by Cobham Gaisler

# RC64

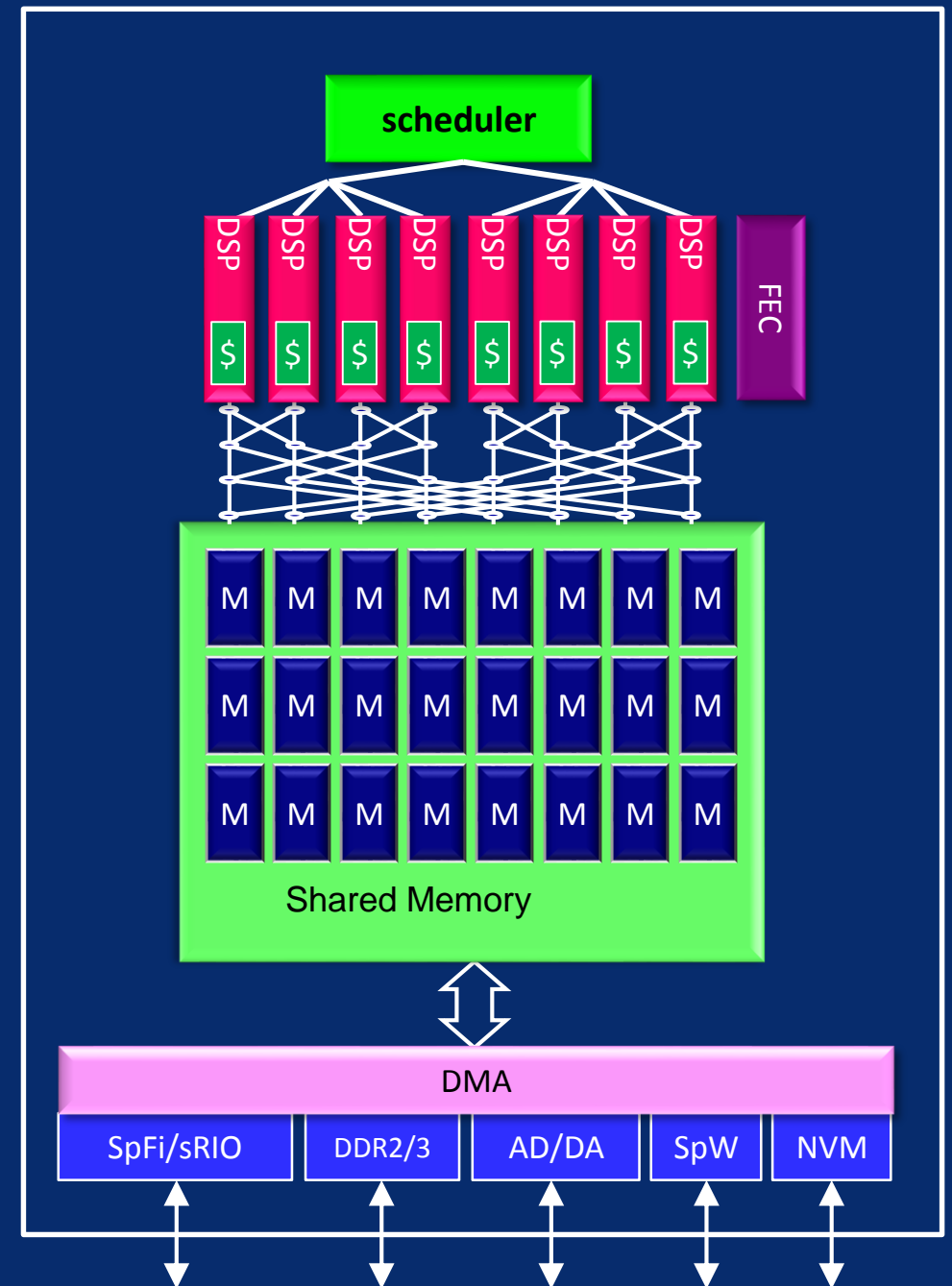


**500x**  
faster than GR712RC

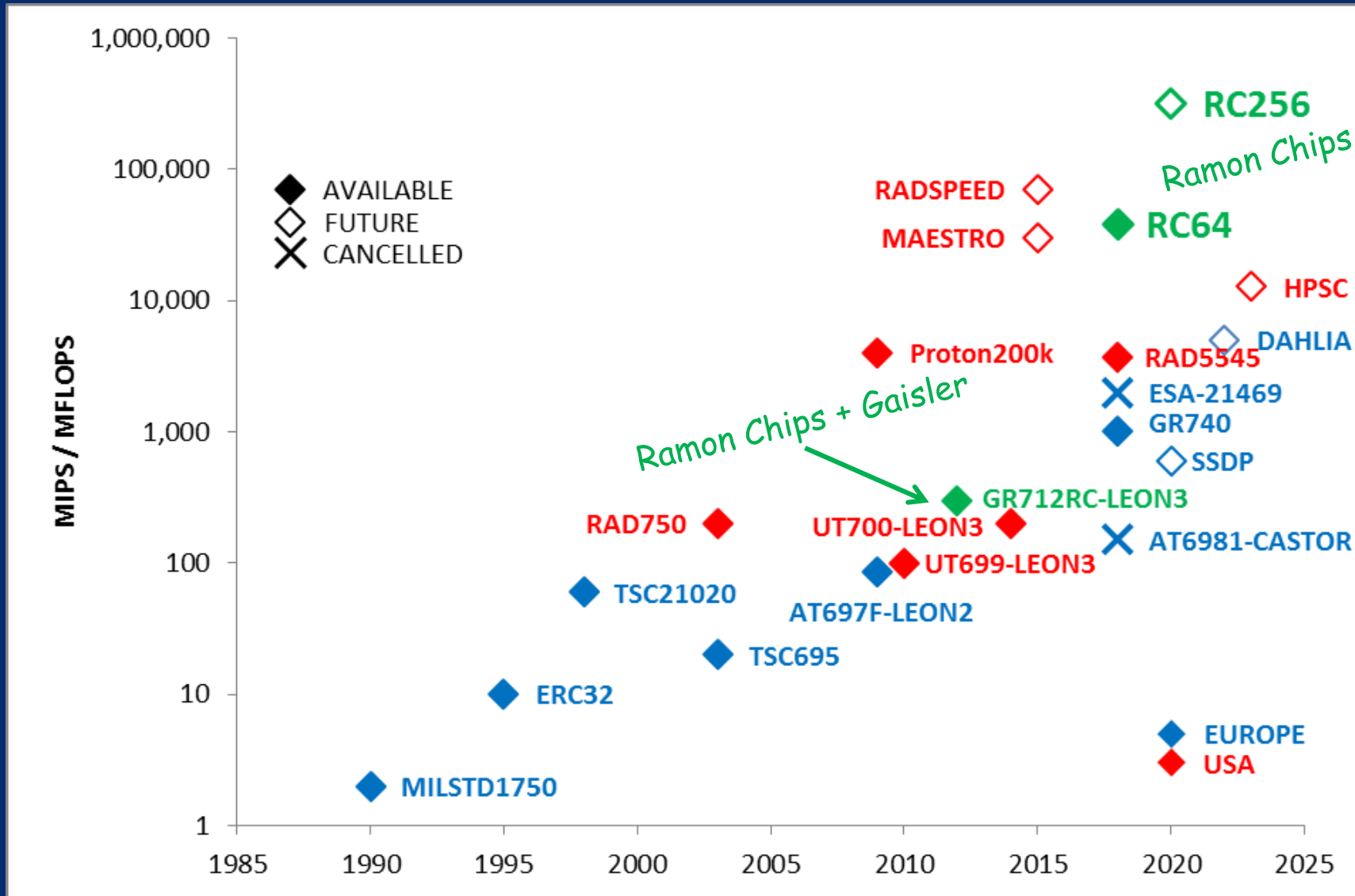
At only 5x power

# RC64

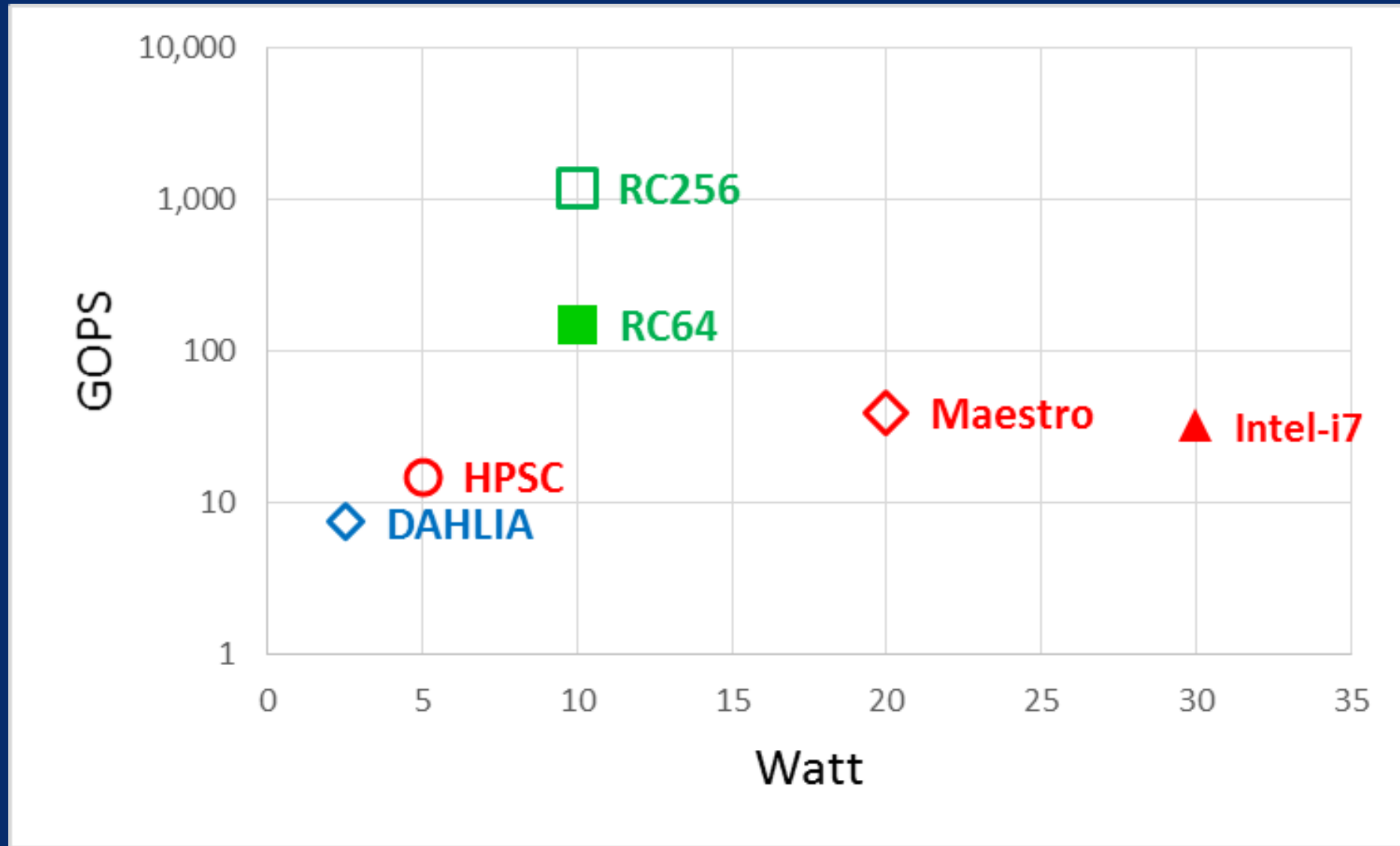
- 64 DSP/CPU CEVA X1643 cores
  - 25 GFLOPS, 50 GMACS, 100 GOPS, 12 GIPS
- HW scheduler
- Modem HW accelerators
- 4 Mbyte EDAC shared memory
- Massive network-on-chip
- Fast I/O
  - 12 SpFi, 1-6 Gb/s
  - 48b DDR3 (R/S EDAC)
  - 48 LVDS, 0.7 Gb/s
  - 6 SpW
  - 8b Flash (EDAC)
- Rad-Hard, FDIR: 300 kRad; SEL, SEU protection
  - Mem scrubbing, fault management
- 65nm LP TSMC
- Power up to 10 Watt
- PBGA 669 (opt. CCGA,CQFP)
- Payload-level qualification (opt. ESCC 9000)
- Designed for **SOFTWARE-DEFINED-PAYLOADS**



# RC64 vs other space processors

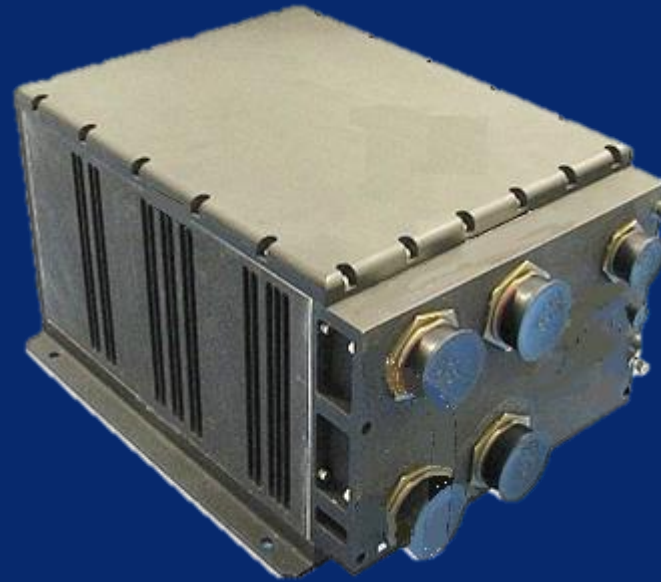


# Performance to Power





# RC64-based software-defined payload NOGAH

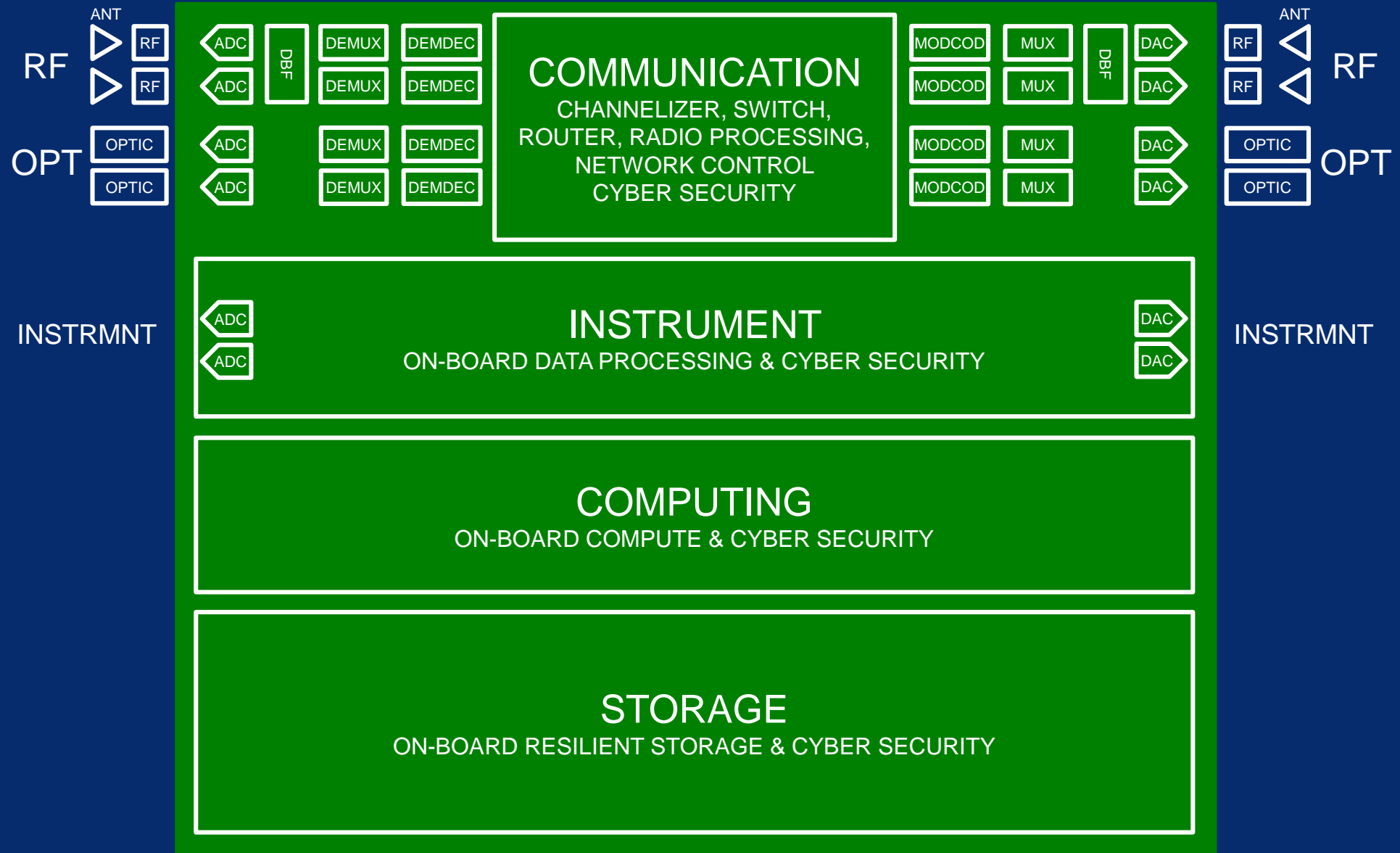


# From RC64 chips to NOGAH systems

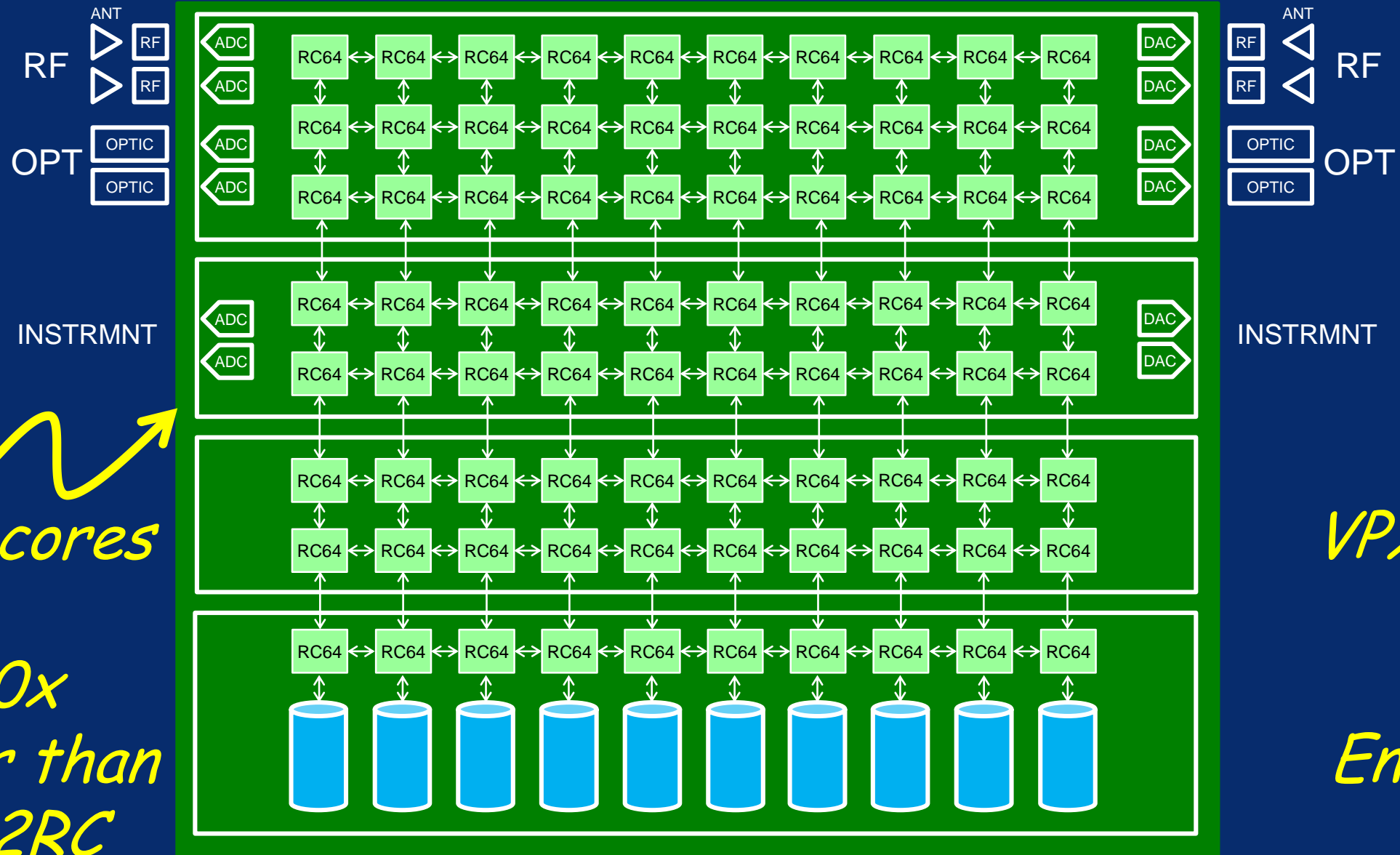
- GAME CHANGING
- Present
  - OBC made by satellite manufacturer
  - One-off
  - Labor intensive
  - Long, expensive
- Future
  - NOGAH system by Ramon Chips
  - Customer can modify software
    - Before launch and in-orbit
  - Quick, less expensive, risk-free



# NOGAH software-defined payload



# NOGAH software-defined payload



80  
RC64  
Chips ↗  
=5,120 cores

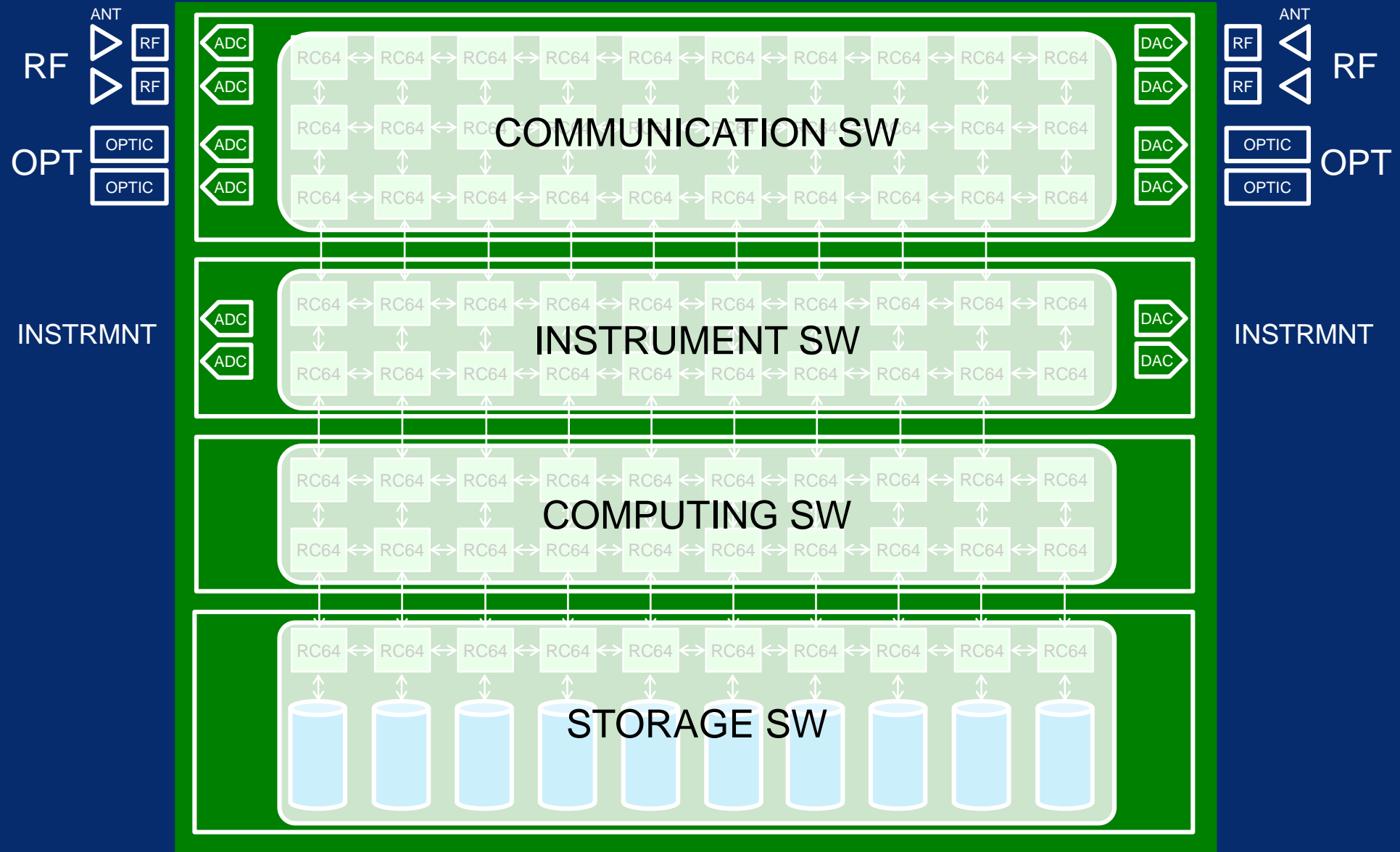
10  
VPX cards

=40,000x  
faster than  
GR712RC

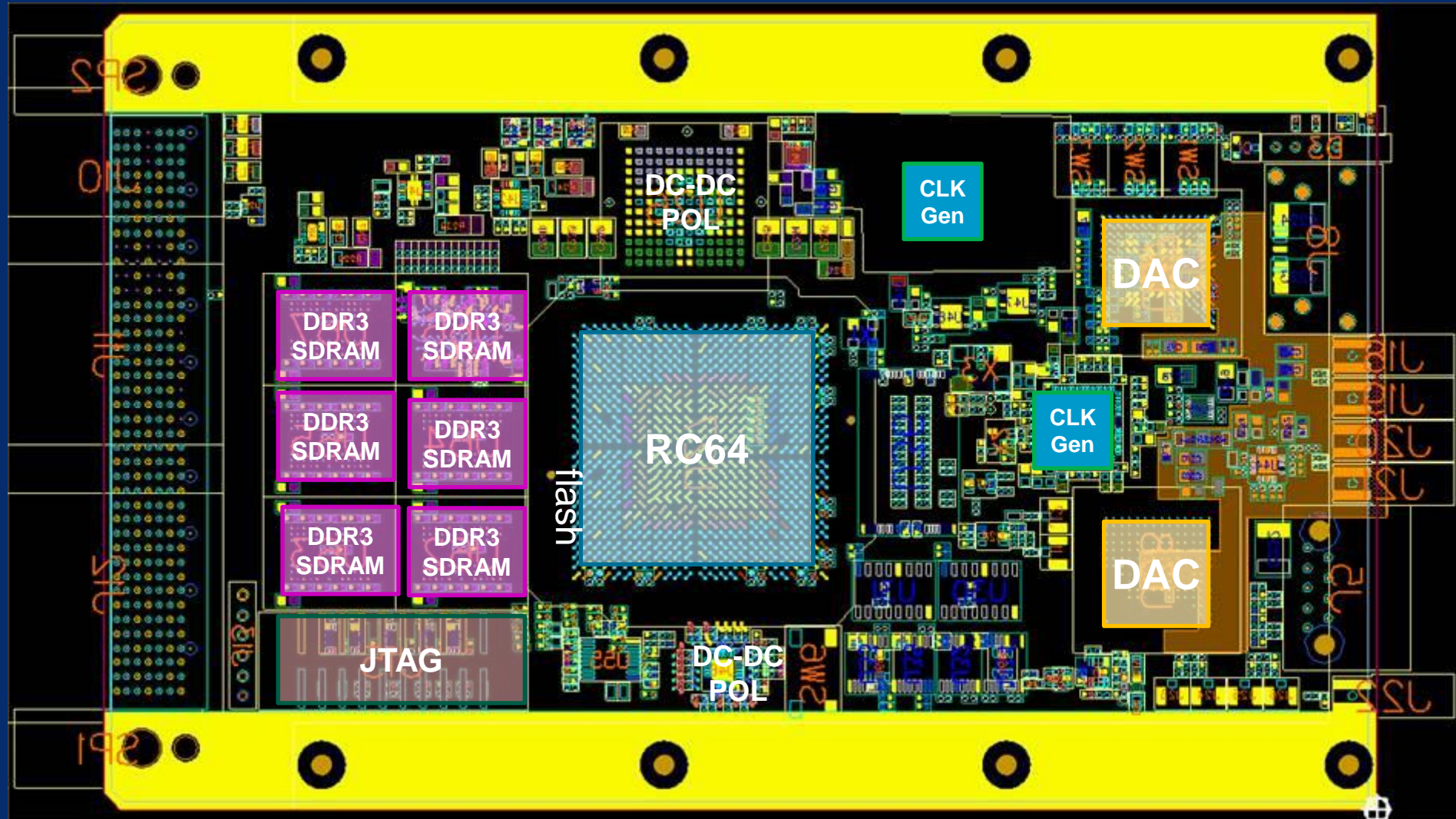
One  
Enclosure



# NOGAH software-defined payload



# Start small: 3U-VPX WB 2Gbps DVB-S2 modem



# LARGE (6U-VPX) Boards and (EOS) Payload Roadmap



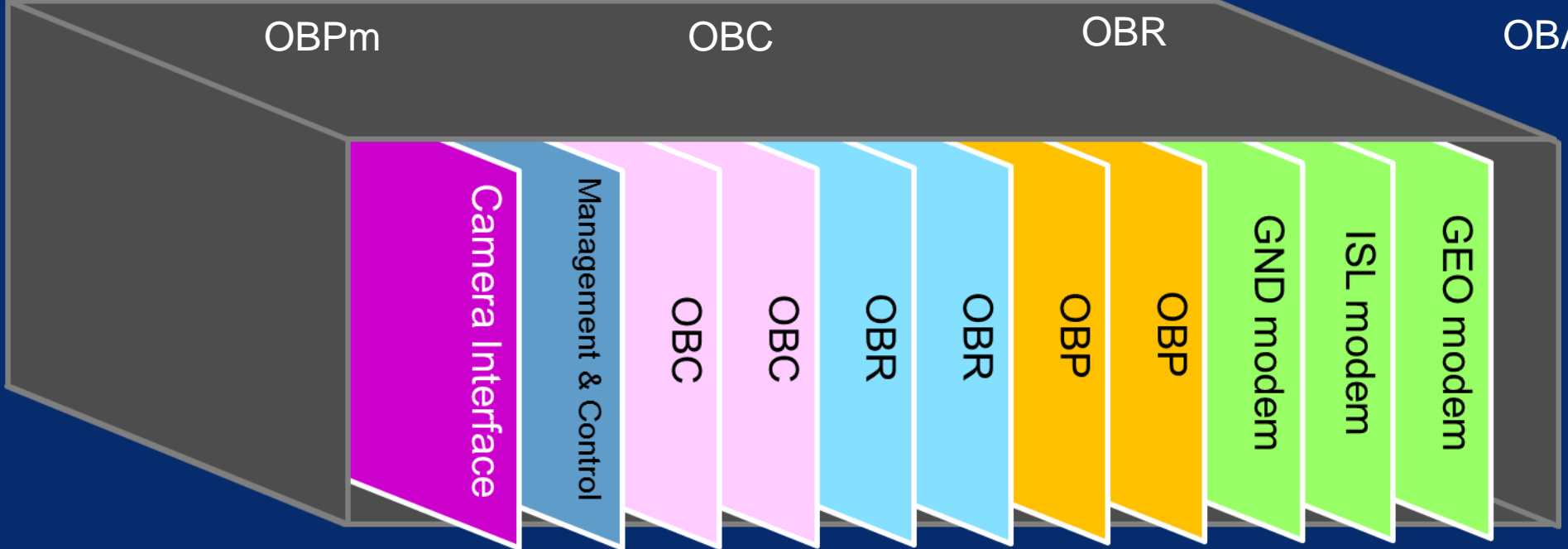
OBP

OBPm

OBC

OBR

OBA



# RC64 SOFTWARE



# Multi-Dimensional Parallelism

① Multi-Processing

Many-Tasks

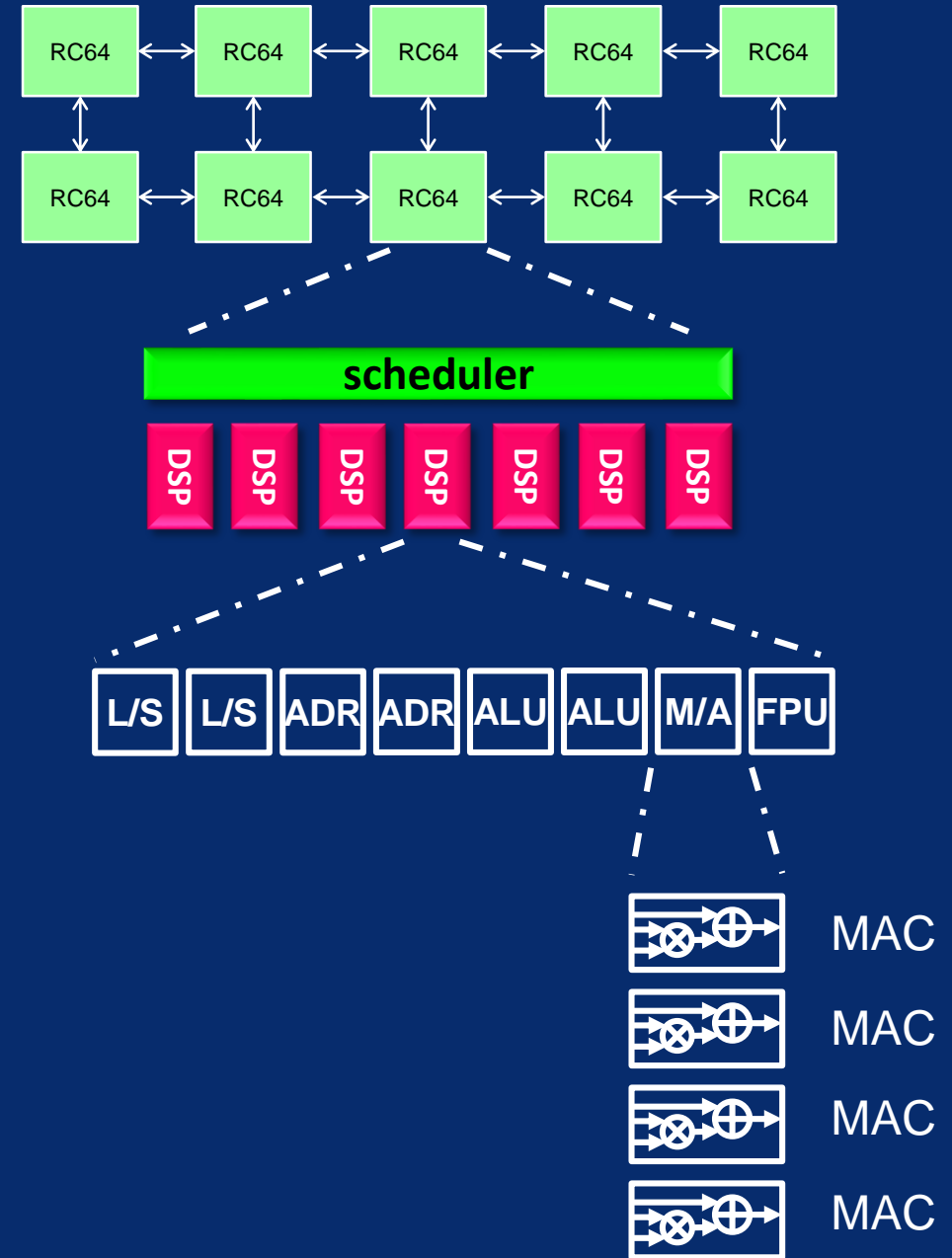
Parallel and Pipeline

②

③

④ VLIW

⑤ SIMD

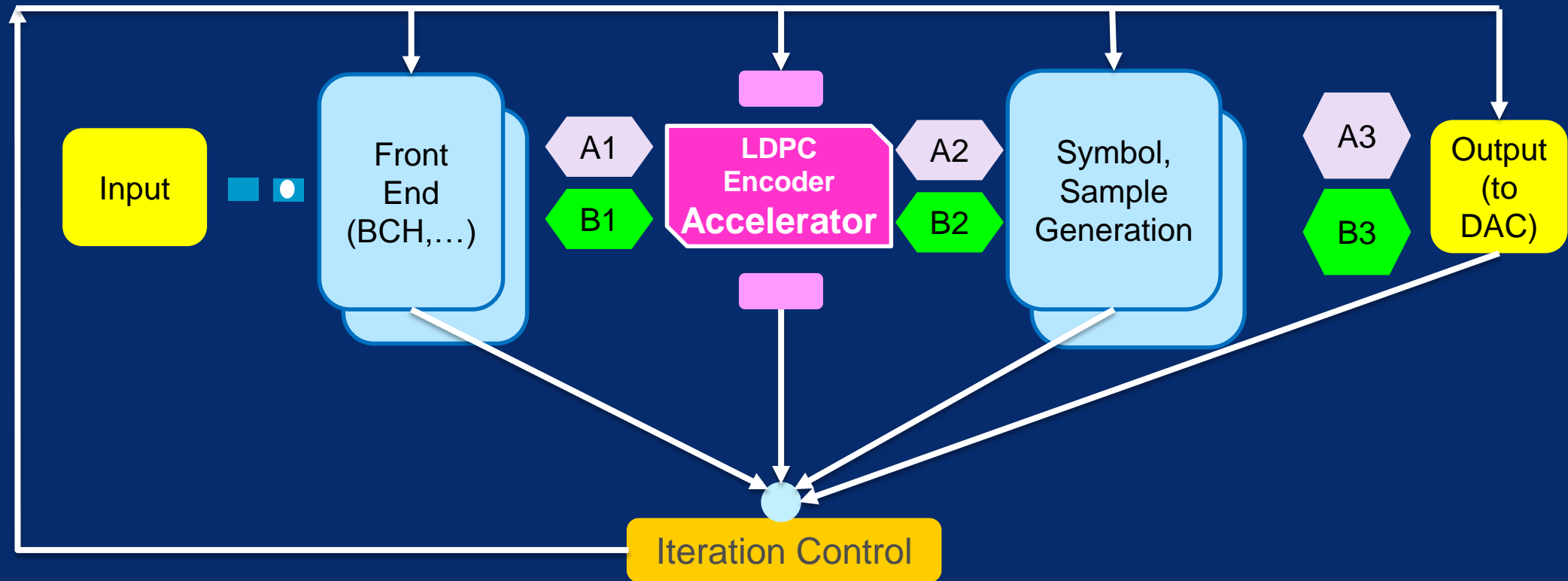


# TASK GRAPH

DVS-S2 transmitter

Pipeline / Parallel execution

Double buffers between stages 



# Parallel Program – Developer Tools

Performance Analysis and Optimization

Profiler

Event Tracer with Time Stamping

Parallel Program Debug

Many Core Debugger

Event Tracer

Parallel Programming

Task Graph Compiler

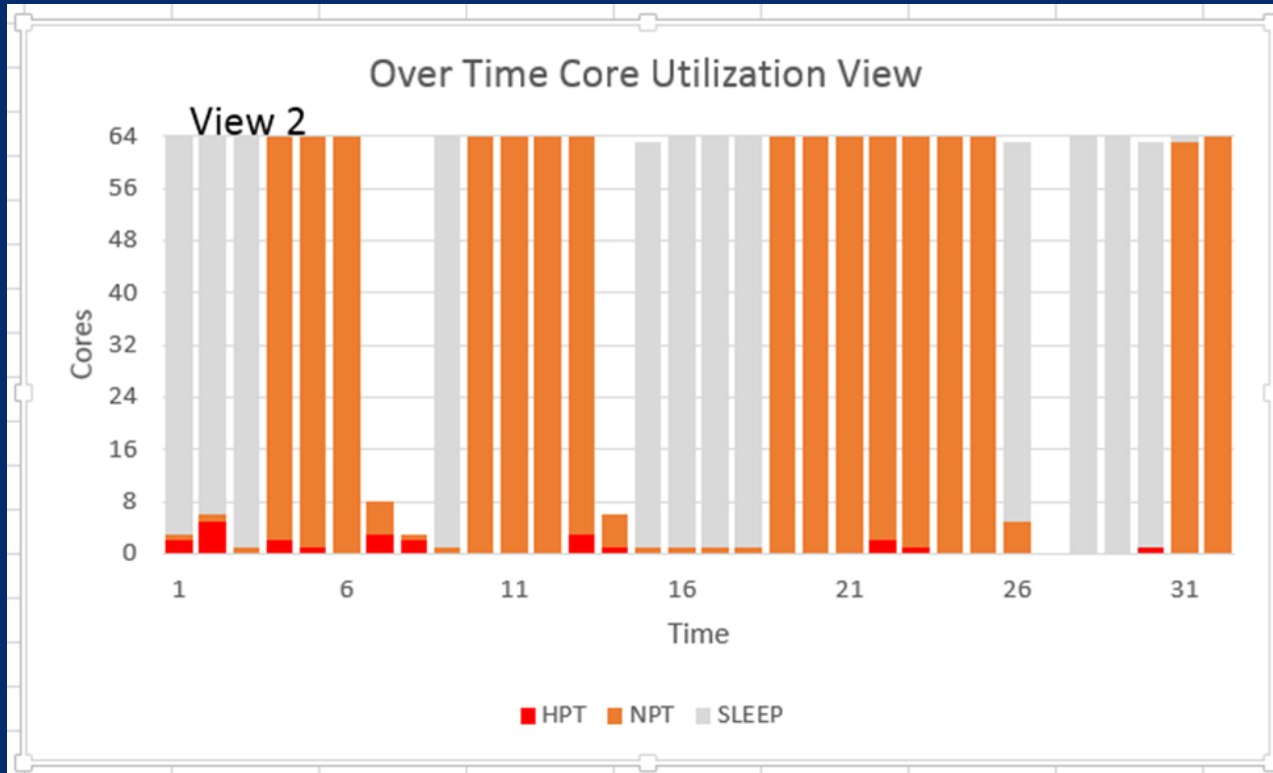
Parallel Program Emulator (MTE)

Task and Program Development

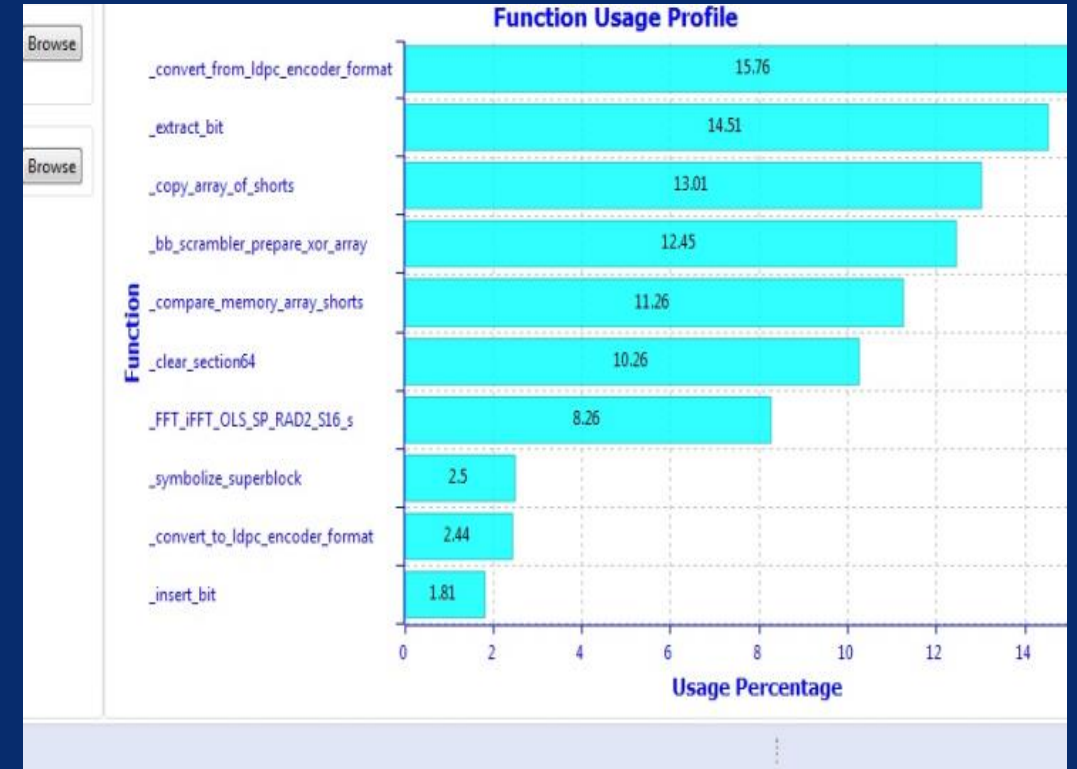
Eclipse IDE  
(Compiler, ASM, Linker)

Float Vector Libraries

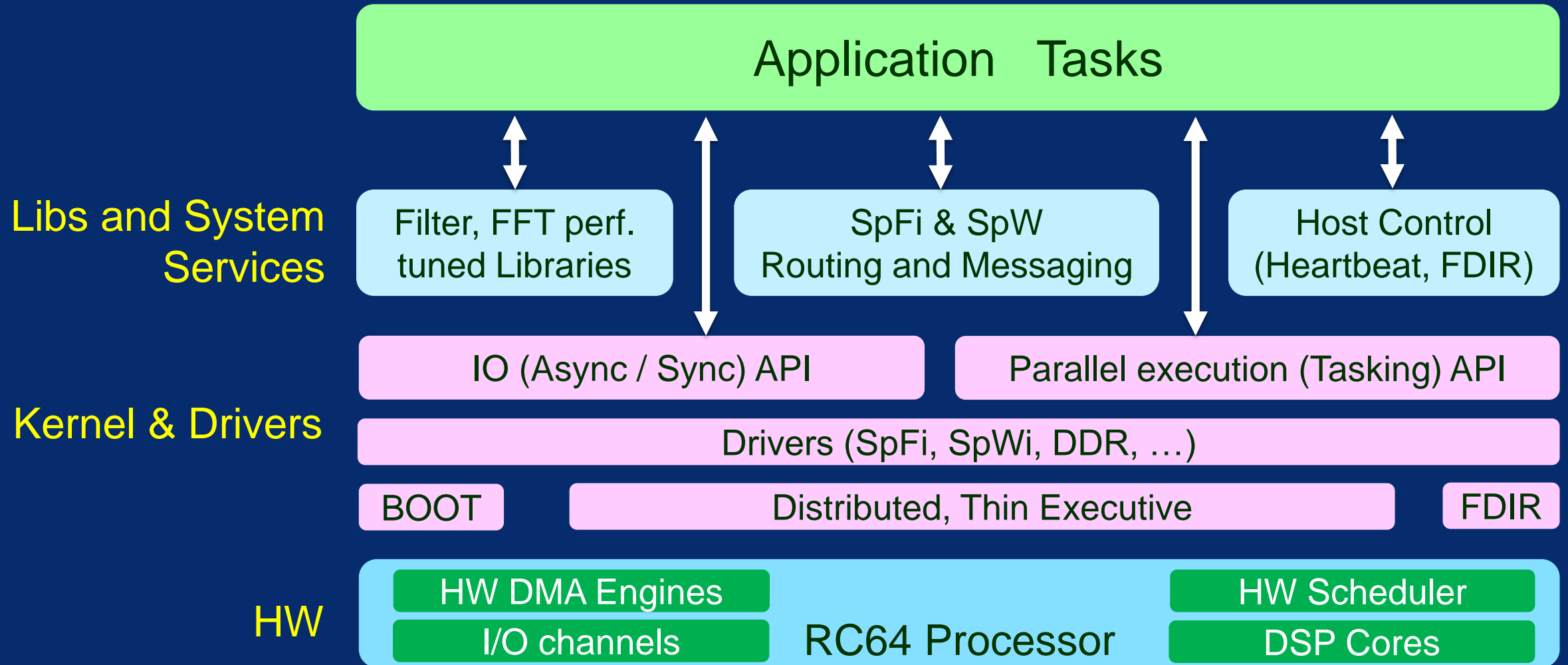
# Profiler Core Utilization



# Profiler Breakdown by Function



# Run Time Architecture





# NOGAH / RC64 applications under development

- Telecom
  - Spectrum Analysis
  - Digital Beam Forming
  - Interference mitigation
  - Channelization
  - Transparent switching
  - DVB-S2X / RCS2 modems
  - IP routing
  - SDN and Constellation Networking
- EOS
  - 2D-FFT for SAR and Telecom
  - SAR Compression
  - Hyperspectral Imaging Real Time Identification
- Computing
  - Resilient Storage
  - Machine Learning
  - Cyber Security

# Join the hands-on Tutorial !

- Two days training
- To be offered at ESTEC
- Early 2018
- Use “Many-Tasks Emulator” (MTE) on your own laptop
- Take MTE home, develop your own applications
  
- CONTACT:        David Steenari  
                         On-Board Payload Data Processing  
                         ESTEC  
                         david.steenari@esa.int





*Thank you!*



[www.ramon-chips.com](http://www.ramon-chips.com)