



# The special radiation-hardened processors for new highly informative experiments in space

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# Three basic branches

## ■ 1X1:

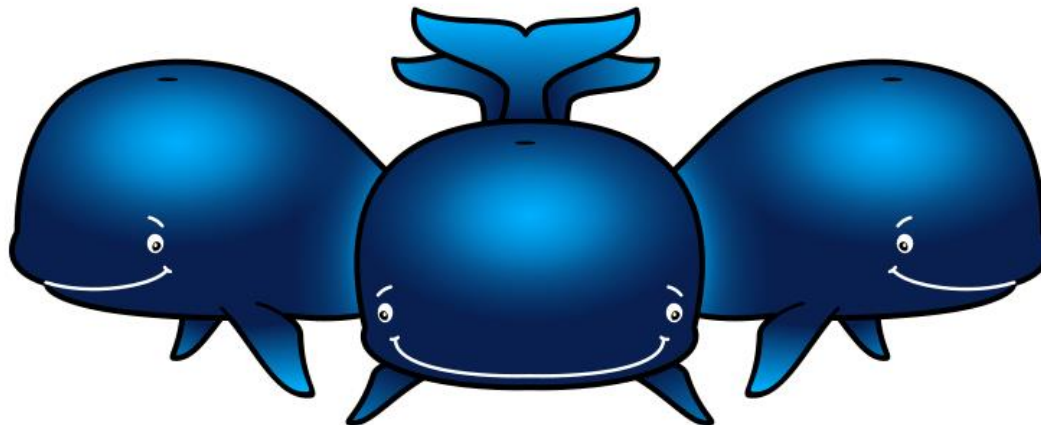
- CMOS 0,5 мкм
- CMOS 0,35 мкм
- SOI 0,5 мкм
- SOI 0,35 мкм
- SOI 0,25 мкм

## ■ Development ASIC and board:

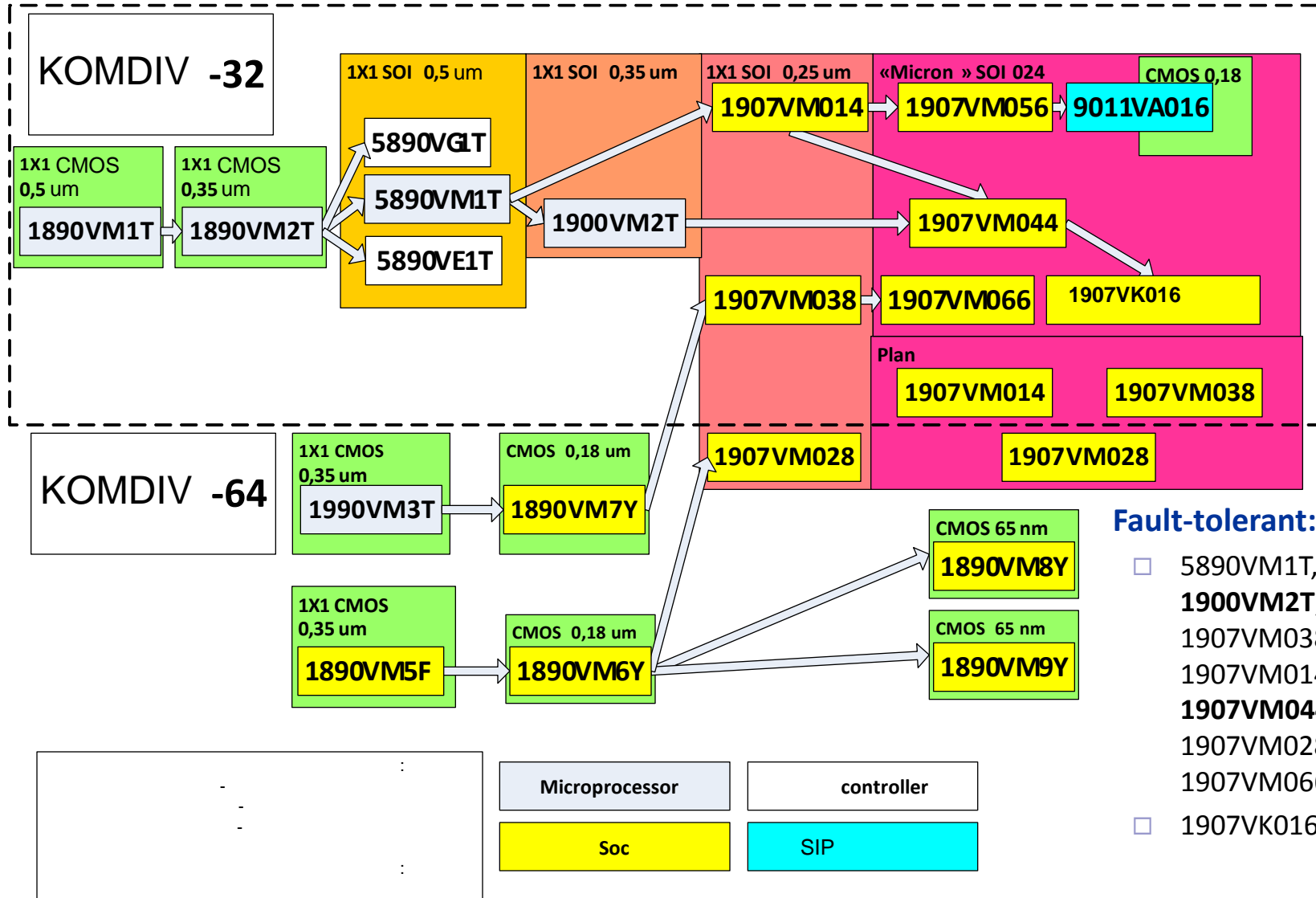
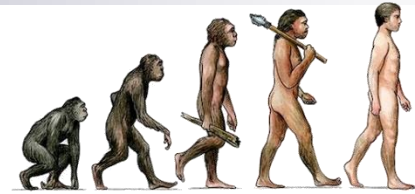
- Microprocessors,
- Peripheral controllers, SRAM...
- Development board, board for testing chips
- Board for GAMMA-400

## ■ Software:

- Real-time OS «Baget»
- Software for testing and debugging

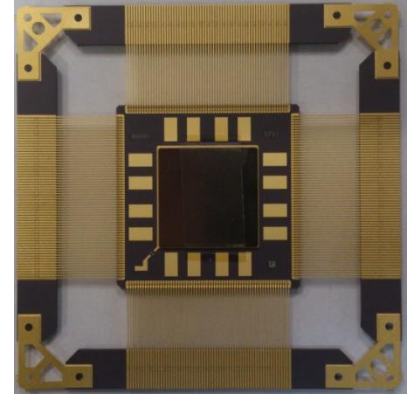


# Microprocessors «KOMDIV»



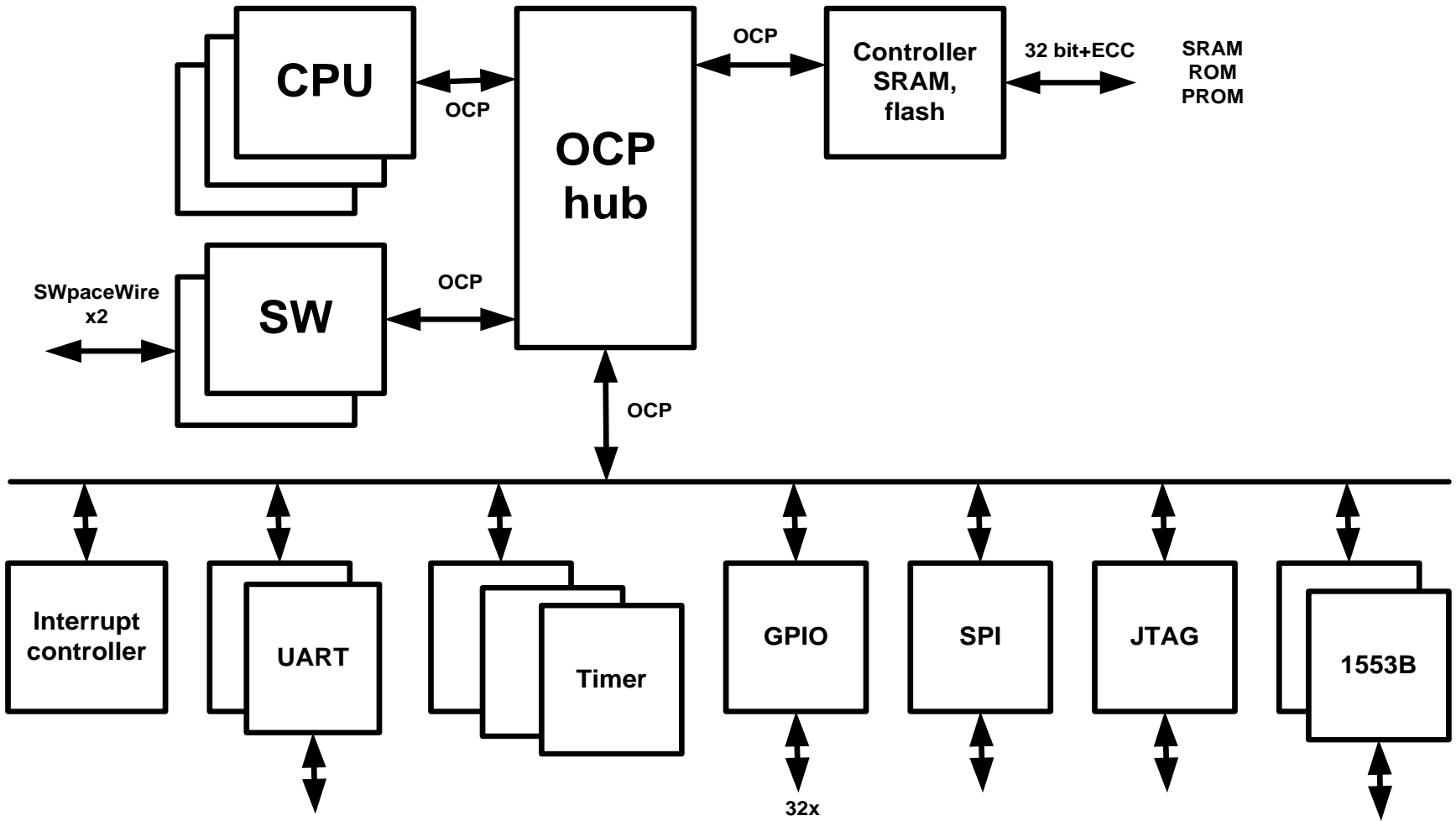
# 1907VM044 system-on-chip

- 0.25  $\mu\text{m}$  SOI CMOS
- 66 MHz
- KOMDIV 32-bit,
- Local TMR
- Redundant SpaceWire interface controller
- Redundant MIL STD 1553B interface
- 3 real time timers
- SRAM controller
- ROM controller
- GPIO
- 2 RS-232 controllers
- SPI
- JTAG





# 1907VM044



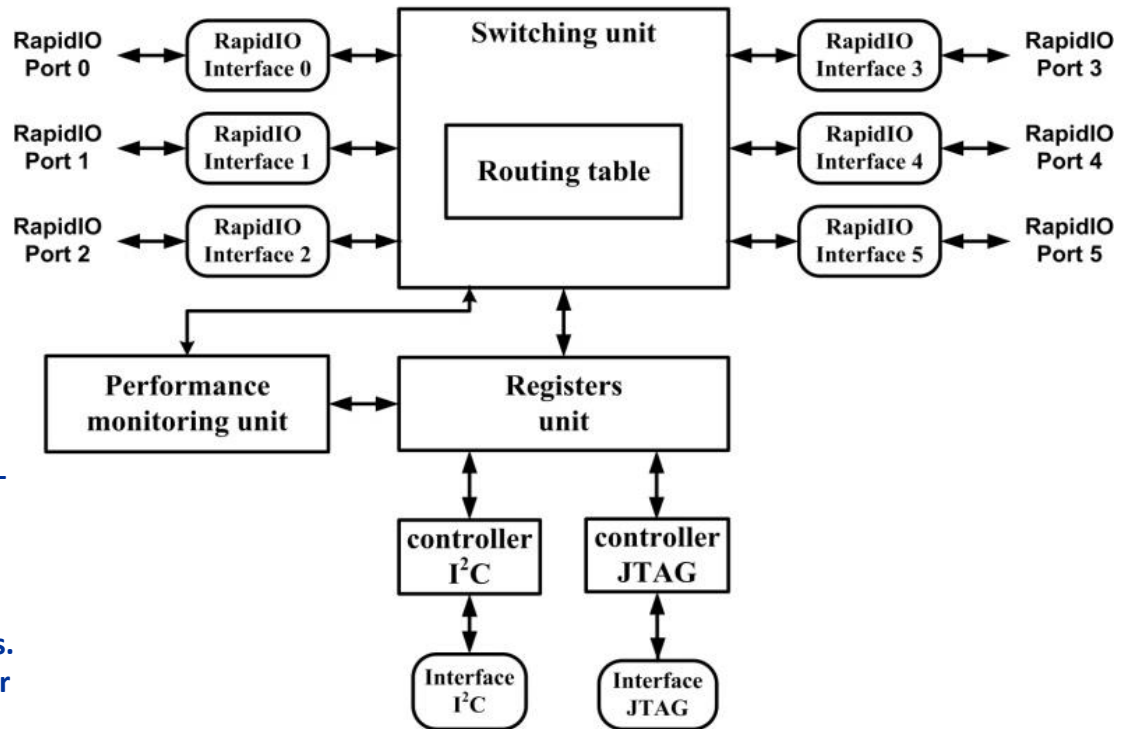


## Fault-tolerant

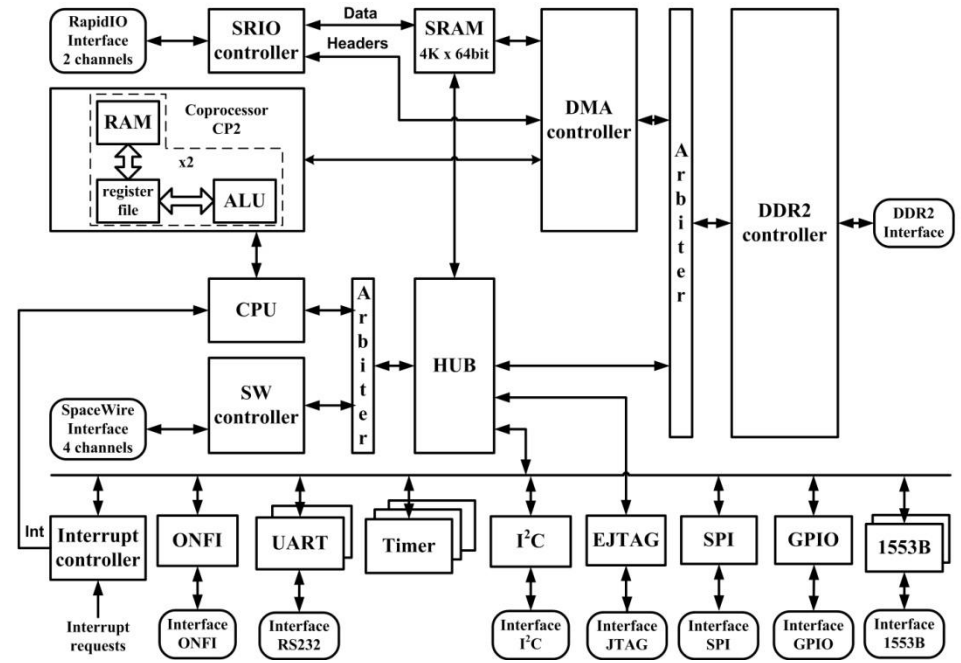
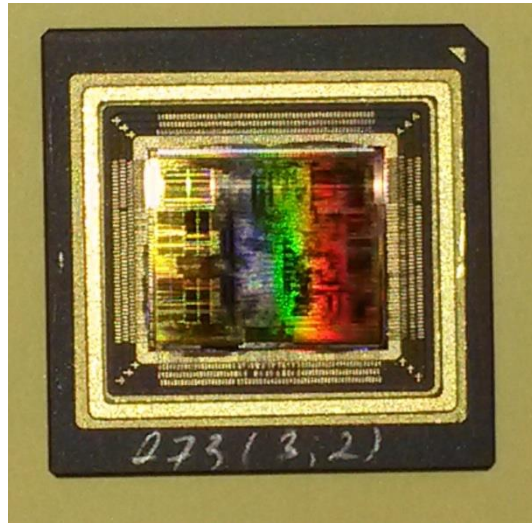
- DICE-cell based cache memory
- Parity bit (1 per byte) for cache memory
- Hamming error correcting code for the built-in MIL-STD 1553 DICE-based memory
- DICE-cells in register files with Hamming code protection (13,8) hardware scrubbing
- SECCDED for external memory
- Hardware possibility of using SRAM in TMR mode
- Spatial separation of neighboring bits (protection from MBU)
- “guaranteed boot” from ROM
- Local TMR
- MBIST
- TID: >200 krad (Si)
- SEL free

# Multiport switch Serial RapidIO 1907KX018

- 0.25  $\mu\text{m}$  SOI CMOS
- is used for the connection of various switches and systems-on-chip
- 6 RapidIO ports, the transferring environment is configured independently: LP-Serial 4X or 1X
- Maximum transferring speed is 1.25 Gbit/sec (per line)
- It has the routing table for each port, performance control system, built-in error-correcting block
- The switch can directly connect up to 256 devices in the system
- Individual routing tables allows to flexibly configure the transferring of data packages.
- The performance control system is used for the defining of characteristics of data flow in channel, overload detection, the localization of locking.



# 1907VM038

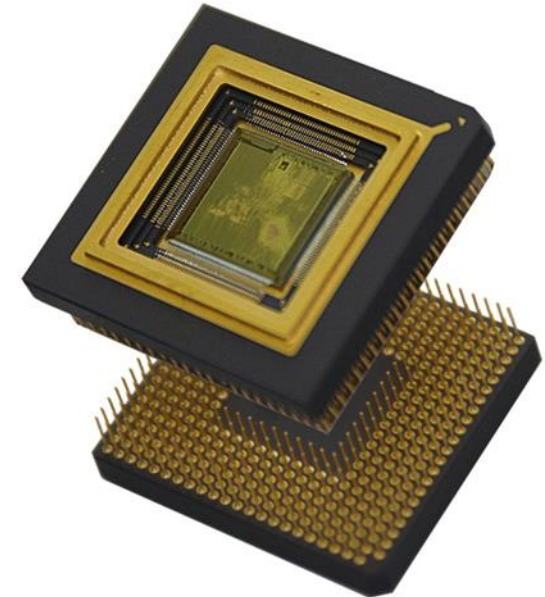
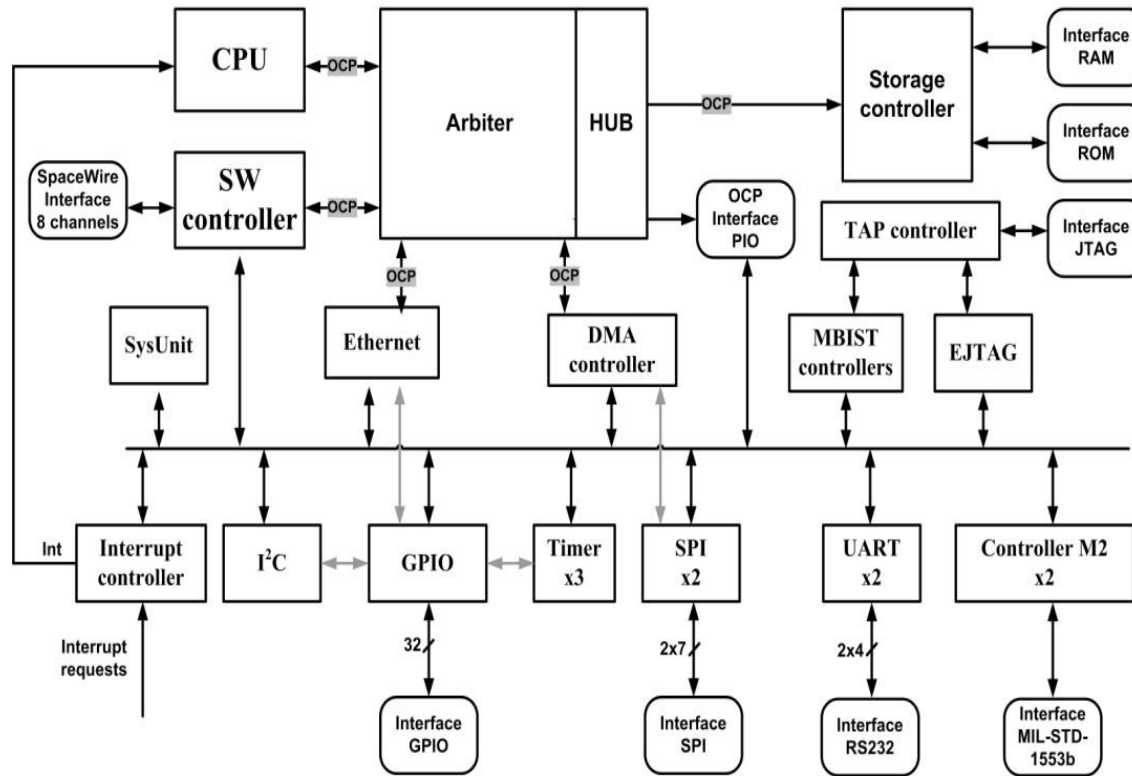


- **System on chip – 128-bit DSP**
  - >2 GFLOPS @ 100 MHz
  - >2 Gbit/s to external memory
- **Architecture:**
  - 32-bit control core
  - 128-bit computational co-processor
  - SPI, DDRII, RS232, RapidIO



# Multiport switch SpaceWire with embedded processor

## 1907VM056

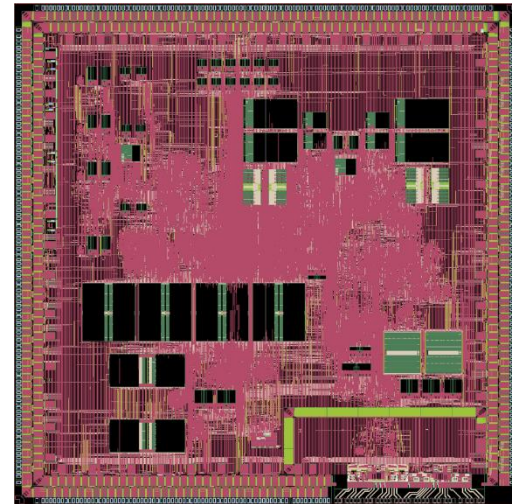
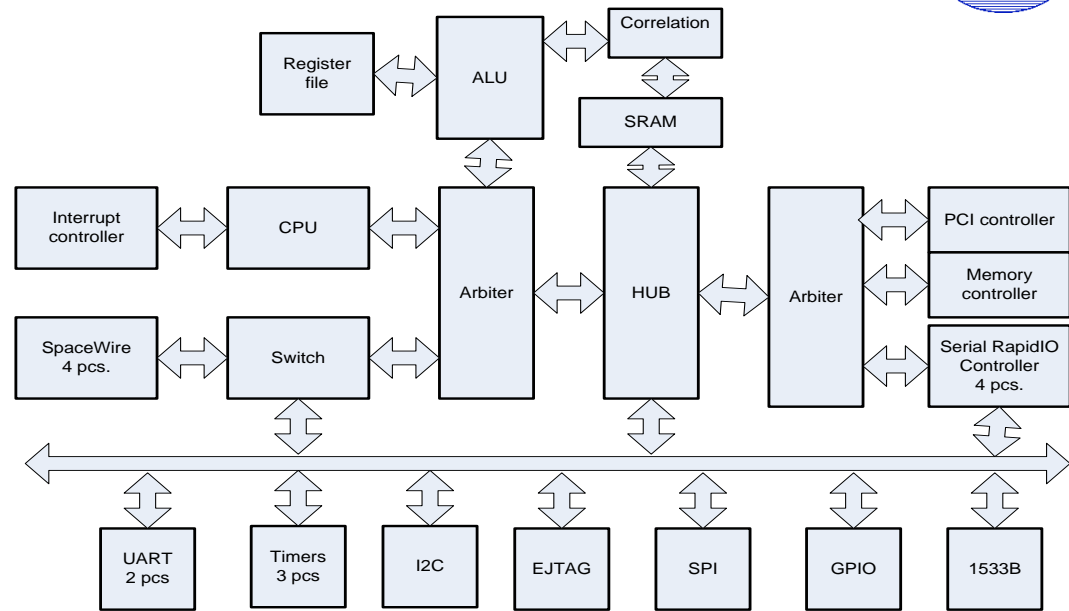


- Frequency – 100 MHz

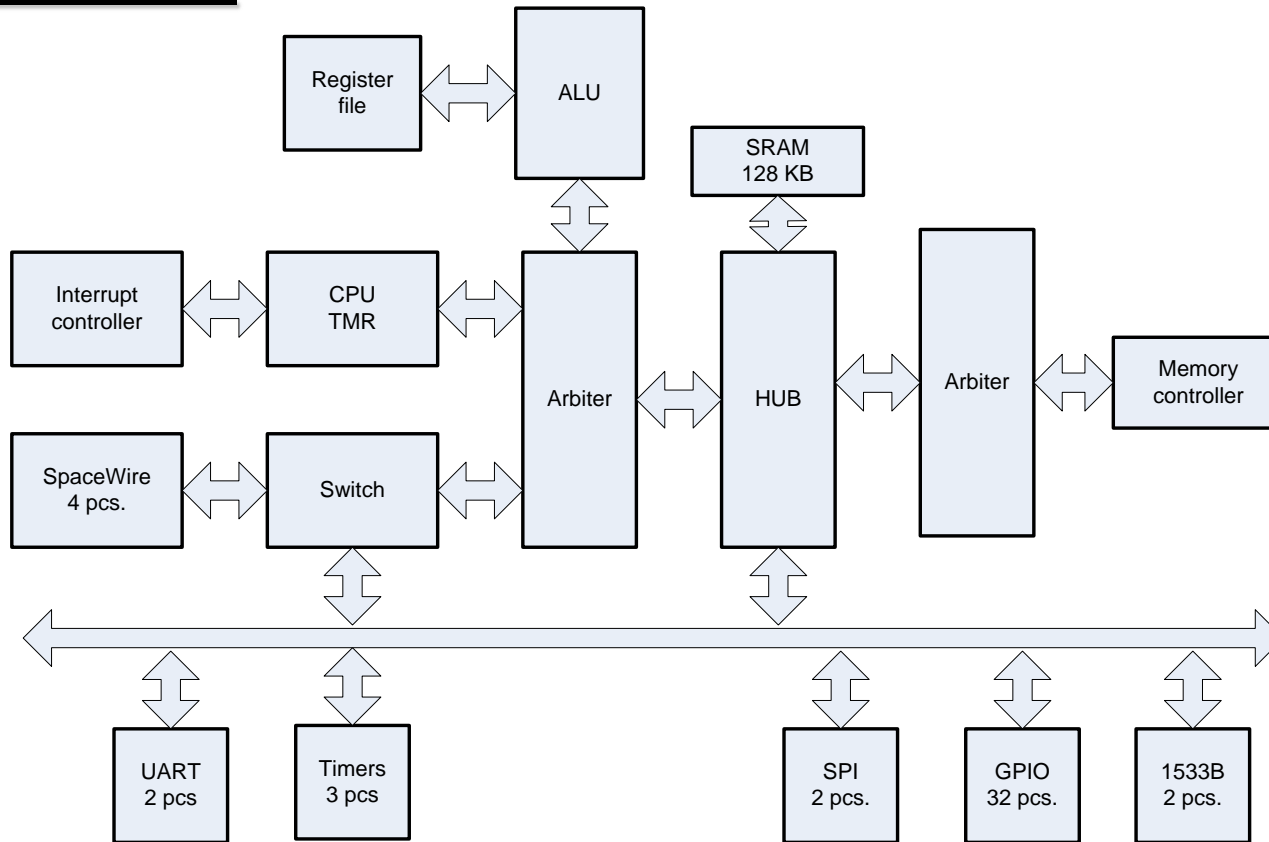
# 1907VM066

- SOI «Micron»
- Rad-hard 32-bit microprocessor with coprocessor processing and compare data image for navigation and on-board systems

- UCC, B 3,3
- Frequency, MHz > 100
- Power consumption @100MHz, W < 6
- Case CPGA 407 pins

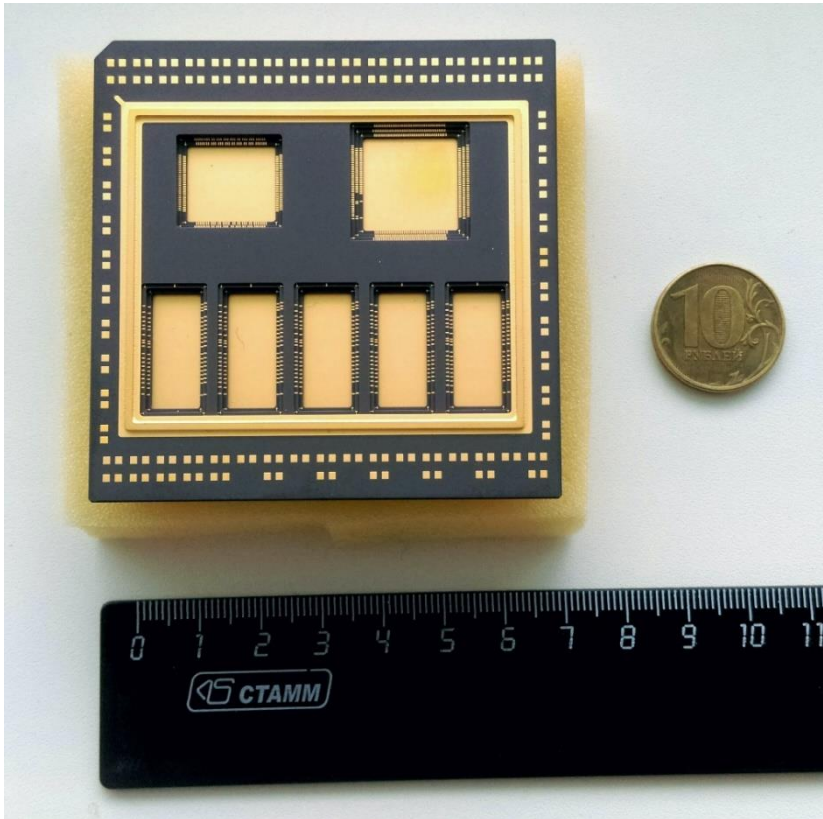


# 1907VK016

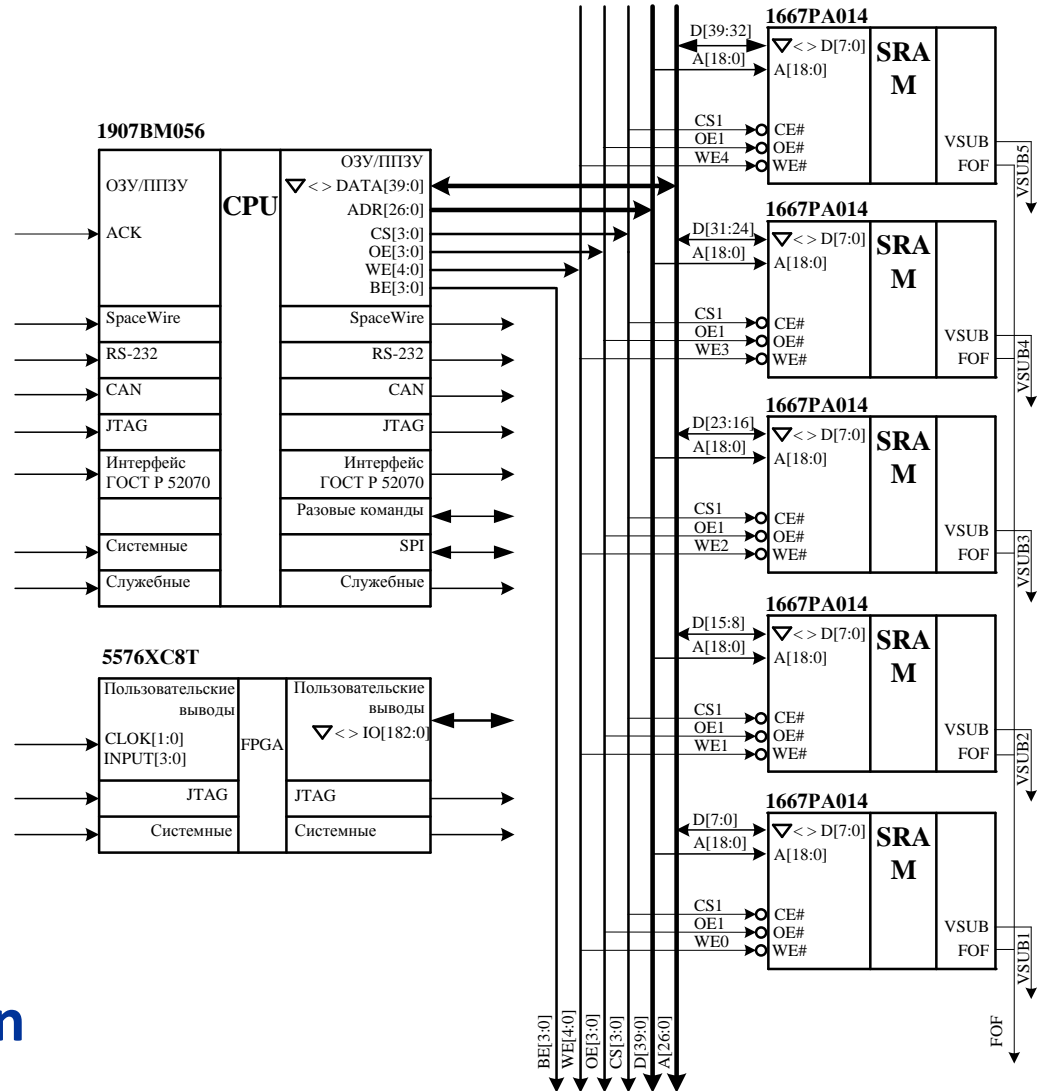


- Fault-tolerant microcontroller with TMR

# 9011VA016



- Processor 100 МГц
- SRAM 2 MB with correction
- FPGA 50 000 gates





## Developing boards

- Central processor unit for SSNI “GAMMA-400” based on 1907VM038
- Control unit for SSNI “GAMMA-400” based on 1907VM044
- Switch Serial RapidIO based on 1907KX018 for OpenVPX systems
- Switch SpaceWire based on 1907VM056 for OpenVPX systems
- Central processor unit based on 1907VM028 for OpenVPX systems
- Central processor unit based on 1907BM066 in form factor PC-104
- Peripheral module with interface 1533B in form factor PC-104
- Performance central processor board :
  - Based on 1907BM028 – 0,1 Gops на 64-bit operand
  - Based on 1907BM038 – up to 2 GFlops на 32-bit operand
- Performance computer up to 2-8 GFlops on 32-bit operand
- Throughput interprocessor channels:
  - Up to 6 channels Serial RapidIO, 1 Gbit/s; up to 6 channels SPACEWIRE, 200 Mbit/s;

**THANK YOU**

**FOR YOUR ATTENTION**

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