

Reconfigurable Heterogeneous Highly Parallel Processing Platform for safe and secure AI

About

The REBECCA project develops a **RISC-V-based ASIC with integrated AI and security accelerators**, for advanced edge-AI systems. Targeted at critical applications like automotive, healthcare, and smart cities, our **ASIC connects to an external FPGA with application-specific AI accelerators** and I/O, enhancing flexibility for complex, scalable AI tasks.

TECHNICAL GOALS

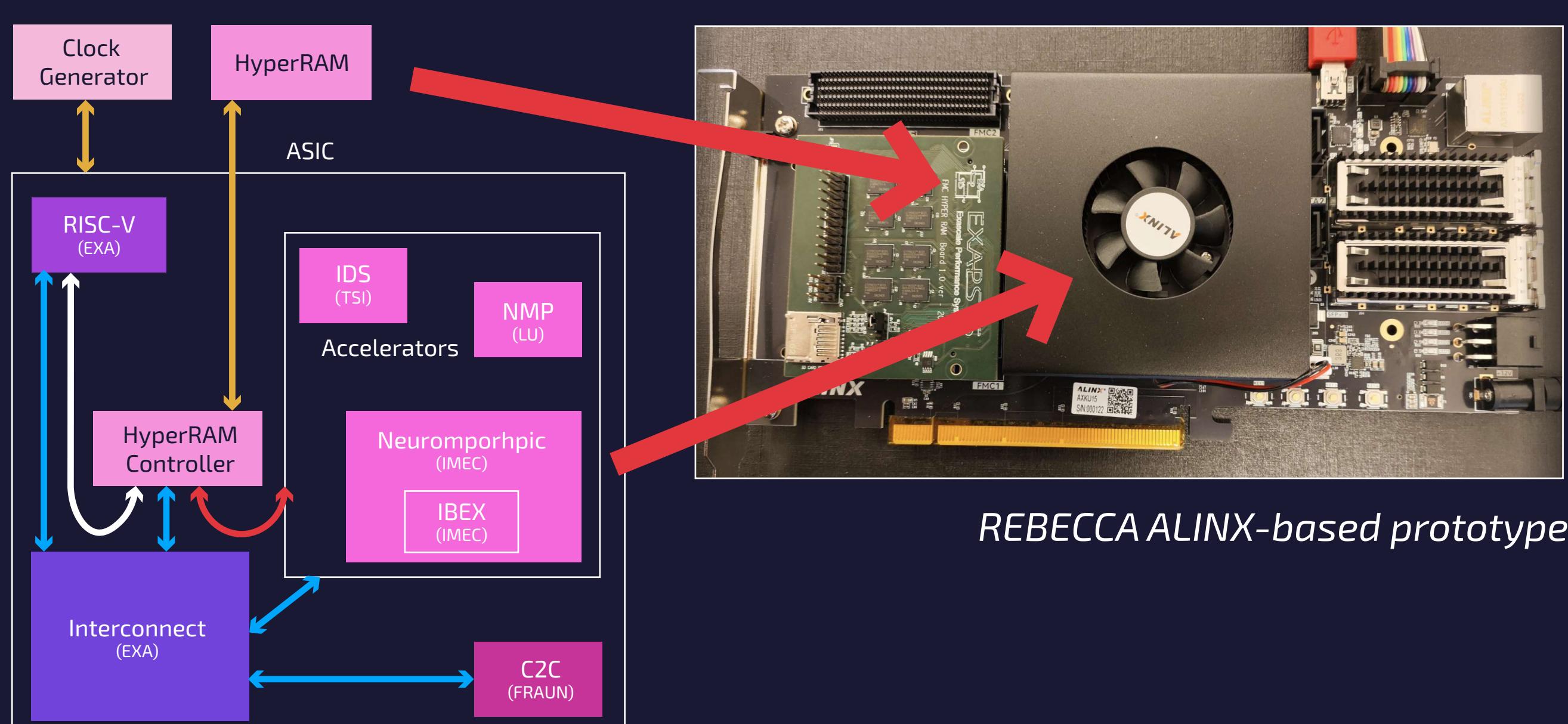
These goals aim to build a versatile, high-performance edge-AI platform

- Scalable RISC-V ASIC
- FPGA for Flexibility
- Near-Memory Processing
- Hardened Security Cores
- Virtualized Software Stack
- Proven Real-World Use

Emulation Flow

ASIC EMULATION

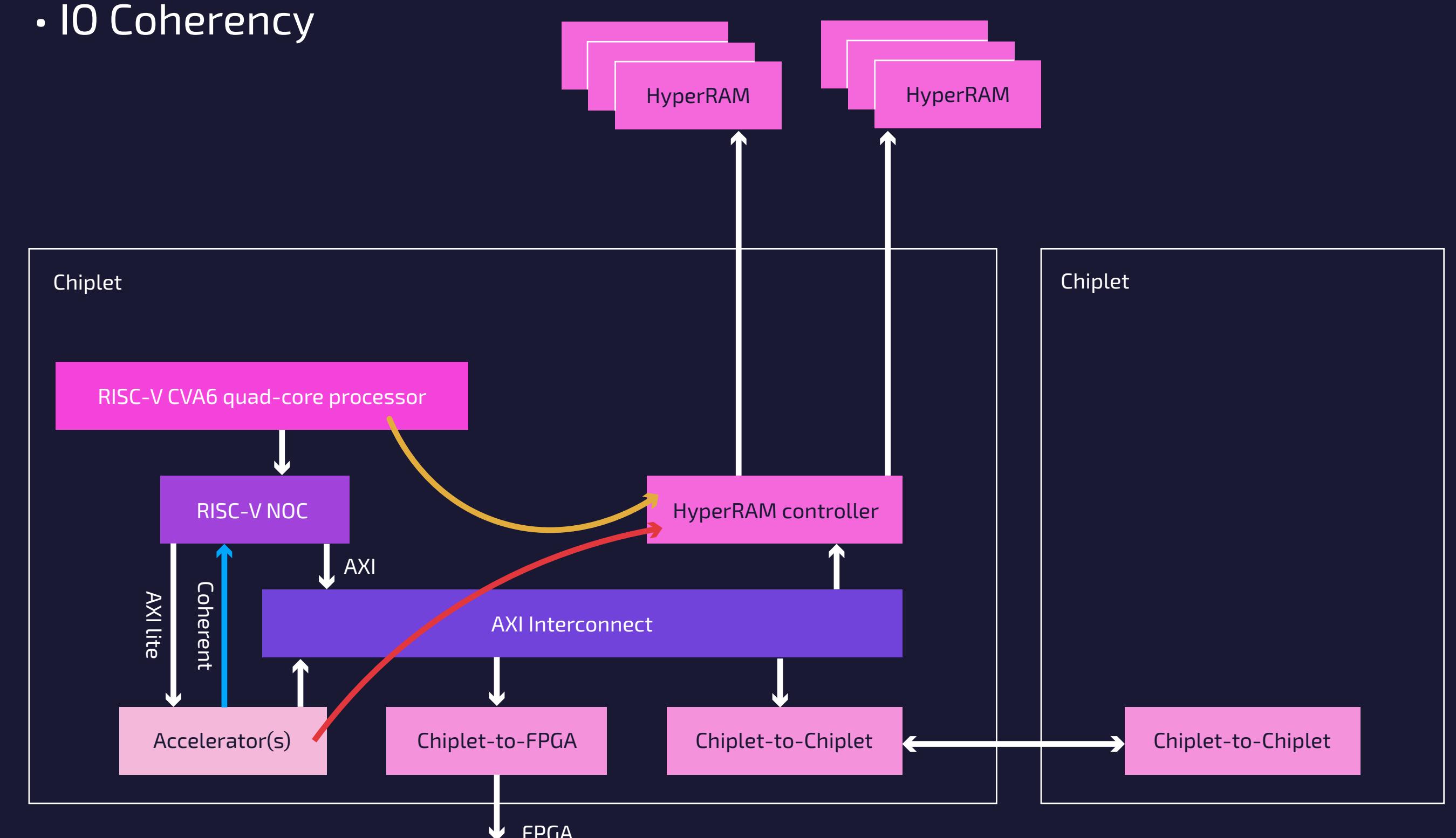
- A proper Linux image corresponding to the new system has been implemented
- Successfully booted Linux (first time CVA6 on ALINX) using 512MB HyperRAM as main memory
- IDS device driver (user space and uio driver)



Global Shared Address Space

HARDWARE GLOBAL ROUTING

- 512 MB HyperRAM
- Chiplet-to-Chiplet
- Shared memory model
- IO Coherency



Software Development

SW ON ALINX

- A proper Linux image corresponding to the new system has been implemented
- Successfully booted Linux (first time CVA6 on ALINX) using 512MB HyperRAM as main memory
- IDS device driver (user space and uio driver)

```
Mem: 61504K used: 491548K free: 208K shrd: 0K buff: 47468K cached
CPU: 0.0% user 0.2% sys 0.0% nvc 88.7% idle 0.0% io 0.0% sirq
Load average: 0.67 ± 0.23 0.08 1/59 151
PID PPID STAT %MEM %CPU COMMAND
13 1 root S 3384 0.7 3 11.2 top
142 1 root S 7204 1.4 0 0.0 sshd: /usr/sbin/sshd [listener] 0
1 0 root S 3384 0.7 2 0.0 /bin/sh
146 1 root S 3384 0.7 2 0.0 /bin/sh
182 1 root S 3384 0.7 0 0.0 /sbin/syslogd -n
166 1 root S 3396 0.4 0 0.0 /usr/sbin/rpcbind
126 1 root TM 399 0.0 1 0.0 /worker/ub0-ev
29 2 root TM 0 0.0 1 0.0 /worker/ub0-ev
32 2 root TM 0 0.0 1 0.0 [rcu_sched]
41 2 root TM 0 0.0 3 0.0 /worker/31+mem
43 2 root TM 0 0.0 1 0.0 [rcu_fair+mem]
2 0 root SW 0 0.0 1 0.0 [xthreads]
40 2 root SW 0 0.0 1 0.0 [kived]
45 2 root SW 0 0.0 1 0.0 [kived/2:1-mm]
34 2 root TM 0 0.0 0 0.0 /worker/0:1-eve
2 2 root IW 0 0.0 0 0.0 /worker/3:1-eve
44 2 root IW 0 0.0 1 0.0 /worker/3:2-eve
3 2 root IWc 0 0.0 0 0.0 [rcu_gp]
4 2 root IWc 0 0.0 0 0.0 [rcu_par_gp]
```

```
# lscpu
Architecture:          riscv64
Byte Order:            Little Endian
CPU(s):                4
On-line CPU(s) list:  0-3
NUMA:
  NUMA node(s):        1
    NUMA node0 CPU(s): 0-3
# uname
uname: uname26
# uname -a
Linux buildroot 6.1.0 #39 SMP Mon Oct 7 13:43:23 EEST 2024 riscv64 GNU/Linux
# free -h
total       used       free  shared  buff/cache   available
Mem:      483372     12604     421988       28     48860     418520
Swap:          0          0          0          0          0          0
```