Strategy to Promote Microprocessor Design Capacity in Bangladesh

CPU design requires design expertise in several specialties: electronic digital logic, compilers, and operating systems. To cover the costs of such a team, commercial vendors of computer designs, such as ARM Holdings and MIPS Technologies charge royalties for the use of their designs, patents and copyrights. They also often require non-disclosure agreements before releasing documents that describe their designs' detailed advantages. In many cases, they never describe the reasons for their design choices.

RISC-V was started to solve these problems. The goal was to make a practical ISA that was open-sourced, usable academically and in any hardware or software design without royalties. Also, the rationales for every part of the project are explained, at least broadly. The RISC-V authors are academic but have substantial experience in computer design. The RISC-V ISA is a direct development from a series of academic computer-design projects. It was originated in part to aid such projects.

In order to build a large, continuing community of users and therefore accumulate designs and software, the RISC-V ISA designers planned to support a wide variety of practical uses: Small, fast, and low-power real-world implementations, without over-architecting for a particular microarchitecture. A need for a large base of contributors is part of the reason why RISC-V was engineered to fit so many uses.

The designers say that the instruction set is the main interface in a computer because it lies between the hardware and the software. If a good instruction set was open, available for use by all, it should dramatically reduce the cost of software by permitting far more reuse. It should also increase competition among hardware providers, who can use more resources for design and less for software support.

The designers assert that new principles are becoming rare in instruction set design, as the most successful designs of the last forty years have become increasingly similar. Of those that failed, most did so because their sponsoring companies failed commercially, not because the instruction sets were poor technically. So, a well-designed open instruction set designed using well-established principles should attract long-term support by many vendors.

RISC-V also supports the designers' academic uses. The simplicity of the integer subset permits basic student exercises. The integer subset is a simple ISA enabling software to control research machines. The variable-length ISA enables extensions for both student exercises and research. The separated privileged instruction set permits research in operating system support, without redesigning compilers. RISC-V's open intellectual property allows its designs to be published, reused, and modified.

VISION

To create a globally competitive electronics design and manufacturing fabless industry to meet the country’s needs and serve the international market.

MISSION

a. To promote indigenous manufacturing in the entire value-chain of microprocessor for economic development.

b. To develop capacities for manufacture of strategic electronics within the country.

c. To promote a vibrant and sustainable ecosystem of Research and Development (R&D), design and engineering and innovation to enhance manufacturing capabilities in electronic raw materials, components, sub-assemblies as well as products.

d. To develop high-quality microprocessor design engineers in Bangladesh at affordable prices for inclusive adoption and deployment to improve productivity, efficiency and ease of operations in other sectors.

e. To promote ubiquitous environmentally friendly best practices in the microprocessor design.

OBJECTIVES

a. To create an eco-system for a globally competitive chip design in the country to tap the market of USD 400 Billion by 2030.

b. To build on the emerging chip design and embedded software industry to achieve global leadership in VLSI, chip design and other frontier technical areas and to achieve competency to work in the global market.

c. To build a strong supply chain of raw materials, parts and electronic components to raise the indigenous availability of these inputs for the local growing electronic industry.

d. To significantly enhance availability of skilled manpower in the microprocessor and VLSI design sector. Special focus for augmenting graduate education with VLSI design technique and to produce VLSI and chip designing engineers by the year 2030.

e. To use technology to develop electronic products catering to domestic needs, including rural needs and conditions as well international need at an affordable price points.

f. To facilitate cost effective loans for setting up fabless chip designing center in Bangladesh.

STRATEGIES

1.1 University Level

a. Include Computer Architecture (RISC and CISC) course in EEE and CSE curriculum

b. RISC V is all hand-on; asking for labs and training

c. Fund RISC V labs in 5 Universities

d. Select 1 most active university to lead the University effort

e. Encourage the selected University to participate in Xilinx University Program[1]

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[1] The Xilinx University Program (XUP) enables the use of Xilinx FPGA and Zynq SoC tools and technologies for academic teaching and research.

f. Provide research grant to teams to develop local RISC V ecosystem

g. Motivate students to develop their own RISC V soft cores

h. Software can be downloaded but Hardware Platform must be purchasable locally

i. Start an Application Development competition to challenge students

j. Provide financial reward for top innovative RISC V based application developers

1.2 Industry Level

a. Provide seed money to proven graduating university teams to start business using RISC V technologies.

b. Provide short term funding to local IT companies to kick start RISC V ecosystem

c. Select one of the local IT Companies to lead the Industrial effort.

d. Motivate the selected IT Company to be local supplier of RISC V based hardware platform

e. Provide financial help to young engineers to get trained in RISC V technologies by the selected IT Company.

f. Create a library of industry best practices for local entrepreneurs, engineers and startups to create the local eco-systems for microprocessor design industry.

1.3 Human Resource Development

To work closely with private sector, universities, and other institutions of learning and to design programs to ensure that, adequate trained and skilled manpower is available to the industry.

a. To facilitate enhancement of the number of graduates and other skilled manpower, especially women by suitably increasing capacities in technical institutions and polytechnics through public and private sector investment.

b. To support creation of capacities within academic institutions to enhance the production of adequate number of VLSI and chip design engineers for supporting the growth of chip design and embedded software and board/hardware design industry in the country.

c. To encourage setting up of skill-oriented courses and training programs for electronic design along with hands-on laboratories enabling graduates from other disciplined to migrate to microprocessor and VLSI design.

d. Creation of a specialized institute for semiconductor design

e. Extending special manpower development program for very large scale integration (VLSI) chip design to include larger number of colleges and students leveraging the national knowledge network.

f. To create an institutional mechanism for the faculty development in various microprocessor and VLSI design related subjects.

g. To collaborate with national and international institutions for development of new skills and courseware on latest manufacturing technologies and products in microprocessor and VLSI design sector.

1.4 Government Level

To facilitate global and national participation of industry and research bodies for promoting standards around microprocessor and VLSI design developed in the country. The government will appoint relevant nodal organization for driving and formalizing standards relating to technology, process, interoperability and services like:

a. Microprocessor and VLSI design standardization

b. Standards for communication within and outside the cloud.

c. International quality/integrity standards for data creation, data traceability.

d. Standards for Energy consumption

e. Safety standards (for example, if devices/sensors are used on humans)

f. Privacy and Security Standards.

g. Create a national expert committee for developing and adopting I microprocessor and VLSI design standards in the country. The expert committee should comprise of industry experts/organizations in following areas:

(i) Identification Technology—Development of Open framework for microprocessor and VLSI design.

(ii) Architecture Technology- microprocessor and VLSI design architecture, platform interoperability.

h. Create a national database for all Thesis, Projects and other development in microprocessor design.

1.5 Governance Structure

ICT Division, Ministry of Posts, Telecommunication & IT will establish an Advisory Committee with representatives from Ministry of Education, Ministry of Commerce, Ministry of Industries UGC, industry and academia for providing ongoing guidance in the emerging area microprocessor design. ICT Division may provide space in the Startup zone, HiTech Park to the deserving companies.

Glossary

ARM	Arm Holdings (stylized as arm) is a global semiconductor and software design company, owned by the Japanese SoftBank Group and its Vision Fund. With its global headquarters in Cambridgeshire, in the United Kingdom, and its US headquarters in San Jose, California, its primary business is in the design of ARM processors (CPUs), although it also designs software development tools under the DS-5, RealView and Keil brands, as well as systems and platforms, system-on-a-chip (SoC) infrastructure and software. As a "Holding" company, it also holds shares of other companies. It is considered to be market dominant for processors in mobile phones (smartphones or otherwise) and tablet computers. The company is one of the best-known "Silicon Fen" companies.
CPU	A central processing unit (CPU), also called a central processor or main processor, is the electronic circuitry within a computer that executes instructions that make up a computer program. The CPU performs basic arithmetic, logic, controlling, and input/output (I/O) operations specified by the instructions.
ISA	Industry Standard Architecture (ISA) is the 16-bit internal bus of IBM PC/AT and similar computers based on the Intel 80286 and its immediate successors during the 1980s. The bus was (largely) backward compatible with the 8-bit bus of the 8088-based IBM PC, including the IBM PC/XT as well as IBM PC compatibles.
RISC-V	RISC-V is a free and open ISA enabling a new era of processor innovation through open standard collaboration. Born in academia and research, RISC-V ISA delivers a new level of free, extensible software and hardware freedom on architecture, paving the way for the next 50 years of computing design and innovation.
The Xilinx University Program (XUP)	The Xilinx University Program (XUP) enables the use of Xilinx FPGA and Zynq SoC tools and technologies for academic teaching and research.
VLSI	Very large-scale integration (VLSI) is the process of creating an integrated circuit (IC) by combining millions of MOS transistors onto a single chip. VLSI began in the 1970s when MOS integrated circuit chips were widely adopted, enabling complex semiconductor and telecommunication technologies to be developed. The microprocessor and memory chips are VLSI devices. Before the introduction of VLSI technology, most ICs had a limited set of functions they could perform. An electronic circuit might consist of a CPU, ROM, RAM and other glue logic. VLSI lets IC designers add all of these into one chip.