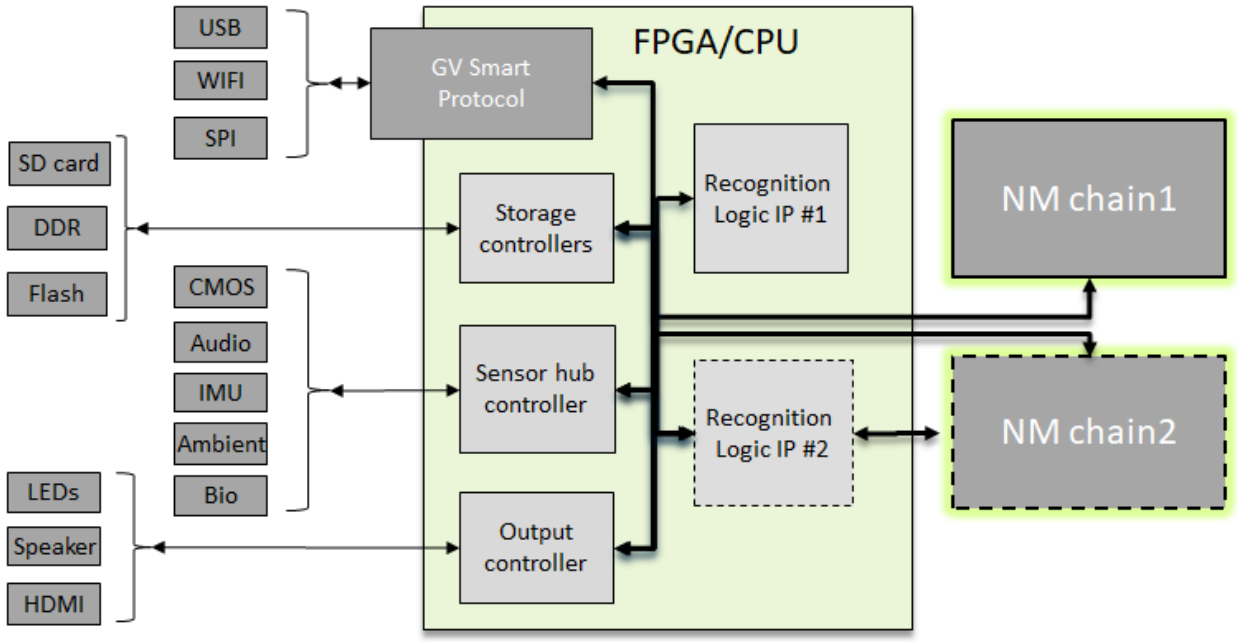
GENERALVISION

NEUROMEM SMART PROTOCOL

General Vision command protocol is a generic register transfer level protocol accessing and controlling the various components of a “NeuroMem Smart” device whether these components are hardware ICs or software IPs are presented in the diagram below.

The GV Smart Protocol can be implemented in compliance with a variety of communication hardware such as SPI, I2C, USB, RS485, etc. Compliance to this protocol ensures the compatibility and portability of your APIs and FPGA IP cores across any “NeuroMem Smart” platforms.



The following table gives examples of typical modules found on a “NeuroMem Smart” hardware. It is non-exhaustive:

Type	Component	Description
IP	Device Info	Access to the settings of the device including but not limited to a hardware version number, FPGA configuration model and revision number, a clock counter, enabling/disabling of communication buses and I/O lines, etc.
HW	NeuroMem networks	Access to the neurons to learn and recognize vectors retrieved from the memory bank or received from another module through a block RAM, save and restore knowledge, etc.
HW	Memory	Access to the memory bank to read/write input datasets derived from text, vectors, images, waveforms; write results generated by the neurons directly or by higher level recognition controllers.
HW	Flash memory	Access to the Flash memory to read and write pages of data, but also to read and decode sequences of instructions for the other modules.
IP	Vector cruncher	Library of functions to learn and classify vectors regardless of their sources. Functions may interact with memory banks and neurons.
IP	Signal Reco engine	Library of functions to acquire, extract features, learn and classify patterns from a variety of signals including biosensors, environmental sensors, audio sensors, etc. Functions may interact with the sensors, memory banks and neurons.
IP	Image Reco engine	Library of functions to learn and recognize visual objects or events from a live or stored image frame. Includes access to pixel values, feature extractions, repetitive or adaptive displacement of a region of interest, result formatting and storage. Functions may interact with the sensors, memory banks and neurons.
HW/IP	Sensor Hub	Configuration and operation of single or multiple sensors, including the enable/disable of the data transmission, edition of sensor settings, etc.
HW	Display	HDMI, MIPI and other type of display control commands
HW	SD card	SPI commands to read/write packets to SD card

THE PROTOCOL DESCRIPTION

The GV protocol is composed of either 4 bytes to access single registers or 10 bytes followed by data packets of variable sizes.

READ/WRITE OF SINGLE REGISTERS

- Byte 0
  - Bit 7 1 = Single register access
  - Bit 6 R/W bit (1=Write)
  - Bit 5-0 6-bit Module ID#
- Byte 1 8-bit Register
- Byte 2-3 16-bit Data length

READ/WRITE OF DATA PACKETS

- Byte 0 Device ID
- Byte 1
  - Bit 7 R/W bit (1=Write)
  - Bit 6-0 7-bit Module ID#
- Byte 2-3-4 24-bit Register or Address
- Byte 5-6-7 24-bit Data length expressed in words
- Byte 8-9 Minimum first 2 bytes of data
- Byte + Remaining pairs of data (up to Data Length)

DeviceID[7:0]	**Address[31]**	**Address[30:24]**	**Address[23:0]**	**Data length[23:0]**	**Data**
DeviceID	Bit 31=1	ModuleID[6:0]	Register[23:0]	Size of the input array expressed in words	Input array of Data_length * words
DeviceID	Bit 31=0	ModuleID[6:0]	Register[23:0]	Size of the output array expressed in words	Output array Data_length * words

The modules and their associated registers are usually defined in header files supplied with the hardware Board Support package and other APIs.

EXAMPLES:

Write the 16-bit value 0x33AA to the MAXIF (Register 0x000007) of the NeuroMem network (Module 0x01)

0x00 81 00 00 07 00 00 01 33 AA

Write a vector of 4 consecutive byte values 9,8,7,6 to the COMP (Register 0x000001) of the NeuroMem network (Module 0x01)

0x00 81 00 00 01 00 00 02 09 08 07 06

Read the 16-bit value of the MINIF (Register 0x000006) of the NeuroMem network (Module 0x01)

0x00 01 00 00 06 00 00 01

Data is returned into 2 bytes or a word. Unless the MINIF register has been written, its default value is 2.

Read the 16-bit value of a CMOS sensor shutter speed (Register 0x0000A0) of the Camera (Module 0x04)

0x00 04 00 00 A0 00 00 01

Data is returned into 2 bytes or a word.

Write 3 consecutive 16-bit values [0x0033, 0x0055, 0x0100] to memory (Module 2) starting at address 0x02000100

0x00 02 00 01 00 00 00 06 00 33 00 55 01 00