Choose the Right Hardware

Proposal Template

Scenario 1: Manufacturing

Which hardware?

Which hardware is most appropriate for this scenario? (CPU + Intel GPU / CPU + FPGA / CPU + VPU)
CPU + FPGA

Requirements

Now that you've picked the hardware, it's time to explain *why* this hardware is the right choice. Look through the scenario and find any relevant requirements. Be sure that you at least include the following:

1. Power Requirements
2. Space Requirements
3. Economic Constraints

Describe each requirement below, along with an explanation of how the selected hardware meets that requirement.

Requirement observed	How does the chosen hardware meet this requirement?
Economic Constraints / Flexibility *Mr. Vishwas wants a device that has **future flexibility**. This can help them create their own code and run it for a specific use-case.*	*FPGA has the ability to be reprogrammed and to be able to adapt to new, evolving and custom networks. Considering flexibility requirement, this makes FPGA more cost-effective in the long run.*
Robustness *Mr. Vishwas wants a system to monitor the number of people **in the factory line**.*	*FPGAs are devices and are specified for 100% on-time, often referred to 7 by 24 by 365 days. The also function on wide range of temperatures, from 0 to 60 degrees Celsius. An industrial type of Intel Arria 10 ranges even wider, from -40 to 100 Celsius. This makes them well-suited for factory floor 100% on-time deployment.*
Space Requirements *Since it is a factory line, he has some space constraints. He can only accommodate **small devices along the line**. These devices can be added to the various computers present on the floors. The maximum number of devices per belt is one.*	*Intel Arria 10 Device (FPGA) packaging ranges from 27 x 27 mm to 45 x 45 mm, which is definitely small enough to accomodate along the factory line.*

Power Requirements *Naomi Semiconductors has been **moving towards an energy-efficient workspace**, but air conditioning, heating, and ventilation nevertheless account for almost 60% of the total energy used.*	*FPGAs use in general more power than ASICs, but are more cost-effective in the long run, and have much shorter time to market. Besides, Intel Arria 10 provide optional power reduction techniques.* *Intel Arria 10 devices (FPGA) leverage a low 0.9 V core power supply and deliver the industry's lowest power consumption per transceiver channel:* *• 12.5 Gbps transceivers at as low as 242 mW* *• 10 Gbps transceivers at as low as 168 mW* *• 6 Gbps transceivers at as low as 117 mW* *The optional power reduction techniques in Intel Arria 10 devices include:* *• SmartVID—a code is programmed into each device during manufacturing that allows a smart regulator to operate the device at lower core Vcc while maintaining performance* *• Programmable Power Technology—non-critical timing paths are identified by the Intel Quartus Prime software and the logic in these paths is biased for low power instead of high performance* *• Low Static Power Options—devices are available with either standard static power or low static power while maintaining performance*

Intel Arria 10 Specification:
https://www.intel.com/content/dam/www/programmable/us/en/pdfs/literature/hb/arria-10/a10_overview.pdf

Write-up

Now synthesize your points from above and provide a brief write-up (not more than about 50 words) describing why the chosen hardware is the best choice for this scenario.

Write-up: Why is this the right hardware?
Taking into account the most crucial requirements are Flexibility, Robustness and Size, only FPGA really fits them all, making it most Cost-Effective solution in the long run. The advanced power saving techniques of latest Intel FPGA devices like Arria 10, will also be in line with the general trend toward energy-efficient workspace.

Queue Monitoring Requirements

Number of people required per queue:	*2*
Time for the process in the queue (ms/s):	*1 shift = 8 hours = 8 * 60 * 60 = 28800 s*
Model precision chosen (FP32, FP16, or Int8)	*FP16*

Scenario 2: Retail

Which hardware?

Which hardware is most appropriate for this scenario? (CPU+In GPU / CPU+ FPGA / CPU+VPU)
CPU + Integrated GPU

Requirements

Now that you've picked the hardware, it's time to explain *why* this hardware is the right choice. Look through the scenario and find any relevant requirements. Be sure that you at least include the following:

4. Power Requirements
5. Space Requirements
6. Economic Constraints

Describe each requirement below, along with an explanation of how the selected hardware meets that requirement.

Requirement observed	How does the chosen hardware meet this requirement?
Power Requirements *One of the major areas of investment for the store is in power and energy. The average energy consumption of the store is about 550 Kwh/square meter. Refrigeration contributes the most to energy usage, while HVAC and lighting also account for most of the rest.*	*The average power requirements of the machines with i7 core processor range from 35 to 140 Watts. This obviously is not the major contributor to power consumption (by far).* *Still, it is better to not introduce additional devices and use the already existing integrated GPUs.*
Space Requirements *No particular requirements in terms of space, but since this is a "smaller outlet in the tiny neighborhood", we can assume that the less additional space is taken by the device(s), the better.*	*An integrated GPUs built-in the already existing billing counter computers are a great choice, as no additional space or device is going to be needed.*
Economic Constraints *Mr Lin cannot afford any new appliances or devices at the moment.*	*Since billing counters already have i7 core processors with integrated GPUs, it is a perfect choice to use these GPUs for inference, as they remain idle most of the time anyway (it is very unlikely that cashier operators run high-definition video games on them while serving customers).* *Therefore, problem can be solved with no additional investment into new devices.*

Write-up

Now synthesize your points from above and provide a brief write-up (not more than about 50 words) describing why the chosen hardware is the best choice for this scenario.

Write-up: Why is this the right hardware?
Existing i7 core processor with integrated GPU is ideal choice since no additional hardware investment is needed. Even when utilized to the full in will consume < 140 Watts which is quite economical as compared to current 550 Kwh/sq.meter used by refrigerators and HVAC system.

Queue Monitoring Requirements

Number of people required per queue:	*2*
Time for the process in the queue (ms/s):	*230 s*
Model precision chosen (FP32, FP16, or Int8)	*FP16 (recommended)*

Scenario 3: Transportation

Which hardware?

Which hardware is most appropriate for this scenario? (CPU+In GPU / CPU+ FPGA / CPU+VPU)
CPU + VPU

Requirements

Now that you've picked the hardware, it's time to explain *why* this hardware is the right choice. Look through the scenario and find any relevant requirements. Be sure that you at least include the following:

7. Power Requirements
8. Space Requirements
9. Economic Constraints

Describe each requirement below, along with an explanation of how the selected hardware meets that requirement.

Requirement observed	How does the chosen hardware meet this requirement?
Space Requirements *But she has over three systems in a small space in the middle of the platform. She does not want an*	*Intel NCS2 Compute Stick (with Myriad X VPU) are good choice here, as they come in a small size of 72.5mm X 27mm X 14mm with the looks of standard thumb drive*

additional bulky device. However, she would love to invest in smaller devices that can be added to the PCs.	*making it ideal for an easy plug-in into CPU, Raspberry Pi or any computing device with a USB port.*
Economic Constraints *Her budget is $100-$150.*	*The Manufacturer Suggested Retail Price (MSRP) from Intel is $69 USD, as of July 14, 2019.* *Fits the budget, possibly even 2 NCS2 sticks can be purchased, as multiple devices can be run on the same platform to scale performance.*
Power Requirements *Not specifically stated but we can still assume it as a secondary requirement as it will somewhat contribute to the overall cost of the solution.*	*Maximum power that individual NCS2 will use is about 4.5W, it is a small overhead (+5.6%) to the existing 80W power consumption of the i5 processor.*
Performance *With streams coming from 7 CCTV cameras, the device(s) should be performant enough to process all this video information.*	*Myriad X VPU reaches over 1 TOPS of compute performance on deep neural network inference. 1 Trillion per second with 7 devices means there is 142 billion operations per second available to a single camera. When processing a few frames per second this should be enough.*

NCS2 with Myriad X references:
https://software.intel.com/sites/default/files/managed/80/10/ncs2-product-brief.pdf
https://newsroom.intel.com/wp-content/uploads/sites/11/2017/08/movidius-myriad-xvpu-product-brief.pdf

Write-up

Now synthesize your points from above and provide a brief write-up (not more than about 50 words) describing why the chosen hardware is the best choice for this scenario.

Write-up: Why is this the right hardware?
Adding VPU, e.g. NCS2 with Myriad X, is well-suited solution here, as it fits the budget, does not require rebuilding of the existing system or adding bulky equipment. NCS2 can simply be plugged into the USB port. The Myriad X VPU performance of over 1 TOPS should be enough to process streams from all 7 CCTV cameras.

Queue Monitoring Requirements

Number of people required per queue:	*7-15*
Time for the process in the queue (ms/s):	*2-5 min, or 120-300 s*
Model precision chosen (FP32, FP16, or Int8)	*FP16*