



White Paper

Two Steps for Getting the Computer System You Need

Specifying a computer for any task can seem like a difficult assignment. With all of the decisions about components, form factor and the like, it's easy to feel overwhelmed. But with a trusted partner and a few guidelines, you can be sure to get the system you really need, without over-shooting system requirements or your budget. The following pages will take you through both the big picture and the details. Starting with the big picture is a good idea—but if you just want to get to the action items, there is a checklist at the end of the paper.

Step 1: The BIG PICTURE

This won't take long, but it is important—you have to start by defining the application that the computer is going to perform.

It sounds simplistic, but defining the application is often where many design projects go sideways. Our definition is perhaps a little more encompassing than others; we believe that the application definition includes the goals for design, acquisition and deployment. You have to be able to answer this question: "When it's installed, how do I know that this is the correct machine?" When you can, you'll be able to give good direction to your value chain partners.

That answer should cover a couple of things:

- What is the machine supposed to do?
 - At the very least, this should cover a) what application software is expected to run and b) any required, built-in hardware. Whether sourced internally or externally, the software and hardware suppliers need to tell you what the system requirements are. Hint: it's a good practice to ask how they set those requirements, and what, if any, leeway there is. Safety factors can overlap.
- Where is the machine expected to perform?
 - It is critical to get a picture of the environment in which the system will be run, such as temperature, humidity, shock/vibration, dust, etc. requirements. Also, it's also a good idea to consider in what kind of configuration the machine will be deployed: shock-mounted, rack mount case; static rack inside a cooled cabinet, desktop case, etc.
- What are the uptime/availability requirements?
 - Is this a mission-critical machine? What happens if it goes down? Do we need fail-over for the whole system, or maybe just on drives? By looking at the "what could go wrong" scenarios up front, you can specify any needed protections for data back-up or machine up-time.
- What product life-cycle must the machine meet (The "Commercial Off-the-Shelf" Decision)?
 - The world of computer components moves quickly. One day you'll be able to buy that old motherboard, and the next, it's gone from the market. That may not be a problem; the newer design likely has a lot more features for maybe less money, and COTS components will be just fine. However, there are a few scenarios that may lead to rethinking a COTS strategy:
 - Is your application dependent on the architecture of a particular processor or chipset?
 - Will you have to manage spare parts and support issues locally, nationally, globally?
 - What documentation will have to change if a component changes? If the motherboard changes, the arrangements of ports on the computer I/O shield may change.

Step 2: The Details

With the Big Picture clearly in focus, now you can get to the details. Following is our list of items that require specification, and a separate form that you can use to spec out your next project.



Items on the Specification Checklist

- System Product Life-Cycle:
 - This was covered under “The BIG PICTURE”, above. What is the timeframe goal for keeping the machine design controlled, and for which individual parts is control critical?
- System Form Factor:
 - This is a function of the eventual deployment, and starts with “what kind of box do you need”? If the system is going into an EIA Standard 19” rack, you need two more pieces of information:
 - System Height Limit:
System height (amount of vertical rack space) is measured in multiples of “U’s”, where 1U = 1.75”.
 - System Depth Limit:
This needs to take into account the computer chassis, connectors to the rear of the unit and a radius for any installed cables.
- Required CPU:
 - Specify the family, clock speed and bus. Examples would be:
 - Intel Core 2 Duo, 2.8GHz, 800MHz
 - Intel Xeon 5500
- Memory:
 - Specify the memory (RAM) required.
 - Please remember that if you need 4GB of memory or more, a 64-bit operating system will be required.
- Storage Requirements—Hard Drive (HDD)
 - There are four decisions here:
 - Number of drives needed.
 - Capacity of each drive--available space in GB
 - Type
 - Technology: HDD system technology is in flux; IDE and SCSI drives are now harder to find. They are being replaced by SATA and SAS systems.
 - Solid State Drive: If you need the durability of a solid state drive (SSD), this is the time to specify it.
 - Removable: If you would like to be able to easily remove your hard drive from the system, hardware must be included to enable that feature.
 - RAID (Redundant Array of Independent Disks)
 - RAID allows for fault tolerance in a machine, and is part of the uptime discussion. Ask your computer design partner for more information on selecting a RAID type for your application.
- Optical Media:
 - Do you need an optical media drive for data input or output? How much data will you want to input/record without changing drives?
- Operating System
 - You may know that Windows XP is going end-of-life, soon. Windows 7 is now the standard OS with which systems are shipped. Windows XP will be available as a downgrade option. Make sure that you are in sync with your supplier about what disks you expect with your unit.
- Video Requirements

- How many outputs do you need?
 - This is a function of how many individual displays you will need to run and/or how many applications you want to display, simultaneously.
 - Typical multiple-output systems have 1, 2 or 4 outputs. Ask your supplier for more information about applications which call for multiple displays in multiple locations.
- How sophisticated are your video requirements? Are the on-board capabilities of most chipsets acceptable or do you require the added power of a video card?
- Expansion Requirements:
 - Expansion refers to the number of slots available for adding other hardware typically available on cards. Several common interconnection types are listed below. Any add-on hardware will spell out the interconnect type and card format:
 - ISA: Industry Standard Architecture
 - PCI: Peripheral Component Interface
 - PCIe: PCI Express
 - Depending on the expansion requirements, two system designs are most common:
 - Motherboard: Holds all chips, memory and the BIOS system. Also provides interconnection for all peripheral equipment, including expansion card slots.
 - SBC/Backplane: A single-board-computer is an abbreviated version of a motherboard. It may have a longer product life cycle. A backplane is an interconnection component that is relatively agnostic; it will accept a broad range of components. Combining an SBC with a multi-slot backplane offers the greatest system flexibility, but usually at a higher cost than motherboard-based systems.
- Communications
 - How will the system communicate with the outside world? Do you need:
 - Ethernet and at what speed?
 - Wireless? Backward compatibility with any IEEE 802.11 standards?
 - Other: Dial-up modem, Bluetooth, audio, microphone, other?
- Other Ports
 - How many other USB, RS-232/422/485, IEEE 1394, other ports are needed?
 - Where should they be (front v rear of chassis)?
- Environmental
 - What temperature, humidity, shock/vibration, chemical, explosion-proof, intrusion specs/standards apply?
 - Will the computer be evaluated as a separate component or as part of a system?
 - For example, if the computer is installed in a shock-mounted rack in a portable case, is the entire system (together) or is each component required to meet a particular standard?
 - Ruggedization
 - Will those environmental requirements result in a specification for the final computer, such as MIL-STD, MIL-S, NEMA, FM, IEC, etc.? These standards are expensive to meet; be sure of the specific section that you need and that it is really needed.
- Power budget
 - Is there a power constraint for the system, i.e., may not exceed a certain wattage limit?

With this background information, you're ready to work with your supplier to create a spec that you know is correct, not over- or under-built, has the support profile you need, and best of all, has acceptance criteria for your materials team.

And now, the form... You will probably recognize the following checklist as the long conversation you have on the phone with your supplier where they ask all of these questions. Don't be afraid to ask for help on making any of the following system decisions. A good supplier who is interested in a long-term relationship will work with you to be sure that your needs are appropriately met.



Computer Specification Checklist

Critical Part? (Y/N)	Item	Requirement	Units
	System Product Life Cycle Desired		Years
	Form Factor (EIA Rack Mount, Tower Case, Other/Specify)		
	Desired Dimensions H x W x D		Inches
	If Rack Mount, Specify Height		"U"
	CPU (Model or Family/Clock Speed/Bus)		
	Memory		GB
	Storage		
	Storage—Drive 1 Capacity		GB
	Technology, HDD/SDD, Removable?		
	Storage—Drive 2 Capacity		GB
	Technology, HDD/SDD, Removable?		
	Storage—Drive 3 Capacity		GB
	Technology, HDD/SDD, Removable?		
	RAID Level		
	Optical Drive (CD, DVD, DVD-RW, etc.)		
	Operating System		
	If RAM ≥ 4GB, 64-bit system is required.		
	Video		
	• Number of Outputs Required		
	• Onboard or Card		
	• Card Type		
	Number of Expansion Slots		
	• ISA		
	• PCI		
	• PCIe		
	• Other (Specify)		
	Communications		
	• Ethernet—Speed and Number of Ports		
	• Wireless (Backward Compatible to What Level?)		
	• Other: Dial-up Modem, Bluetooth, Other?		
	Ports		
	• USB: Number, Location		
	• RS-232: Number, Location		
	• RS-485: Number, Location		
	• IEEE 1394: Number, Location, Backward Compatible?		
	• Other (Specify): Number, Location		
	Environmental		
	• Operating Temperature		°C/°F
	• Storage Temperature		°C/°F
	• Humidity		% RH
	• Other Environmental Requirements		
	• Ruggedization Standards, e.g., MIL-STD, MIL-S, NEMA, FM, IEC, etc.		
	Power Budget?		Watts