

*Project Design Review*

**Monday, November 2, 2009, 2:30-5:30 PM, KEN330**  
**Wednesday, November 4, 2009, 2:30-5:30 PM, KEN330**

The goals of a design review are to convince others that a) your design meets the requirements described in your functional specification, b) that your implementation will work correctly, and c) that your design is efficient, wasting no money, power, or circuit board area. Thus, you need to address two aspects of your project:

- the *architectural* choices you made
- the *implementation* choices you made

For example, if your functional specification says that you will accept input over an RS232 serial communications link, your architecture must include support for this requirement. At the implementation level, your schematic must show appropriate choices for components to support RS232, and the components must be correctly connected. If an implementation has component design choices, those choices must be backed up with solid arguments, preferably mathematical derivations and/or simulations.

You should be prepared to answer any and all questions regarding both architecture and implementation.

## What to Bring

Your presentation should be a professional PowerPoint (or similar) presentation. Bring the presentation on a USB drive, CD-ROM, or all of the above. Do not count on Internet connectivity.

Visit the room well ahead of time to familiarize yourself with the equipment (does the CD-ROM work? is the USB drive recognized? how do I log in to the computer? how does the projector work?)

To support your presentation, you must include paper copies of:

- your schematic(s) – this is your primary design document and must be correct, complete, up-to-date, legible, labelled with the most specific part numbers, etc. See the relevant Appendices in your lecture notes on guidelines for drawing schematics.
- your bill-of-materials – this document must have components which reference parts on the schematic (e.g., IC1) or clearly indicate parts external to the schematic (cables, power supplies, etc.) The BOM must include at least 10 columns:
  1. manufacturer
  2. manufacturer part number
  3. part description (e.g., “5-pin connector”, “Quad XOR gate”)
  4. supplier
  5. supplier part number
  6. schematic reference name (if on the schematic)
  7. cost per unit
  8. quantity

9. total cost for this part
10. comments/notes (e.g., operating temperature range, acceptable substitutes, lead times, etc.)

The BOM must have a summary total of project cost, including off-board materials.

The off-board materials must be clearly separated from the circuit board materials.

- datasheets of non-standard parts – if your design uses components that others may not be familiar with, you must include summaries of the data sheets. These should represent just the first page (or first few pages) so that others know what the part does.

Do not include the entire data sheet unless it's either reasonably short or highly relevant.

Do not include datasheets of 7805, MAX232, 74xx chips, or other parts that are familiar to everyone. Not sure what to include? Ask!

- mechanical drawings of non-standard components – you need to include a LEGIBLE 1-page mechanical drawing of all switches, connectors, mounts, etc.
- software design documents – flowcharts, module block diagrams, dataflow diagrams, pseudocode, whatever serves to explain your approach. These need to be SIMPLE enough to be understandable and legible. It is likely that only small parts of your overall code will need to be explained here. “Simple” tasks like responding to pushbuttons, etc. do not need to be justified.
- anything else that supports your assertion that your design will meet the functional requirements and is correctly and completely implemented. This may include calculations, simulations, graphs, analyses, etc. Commonly included calculations/derivations/simulations are:
  - power consumption/current consumption/battery life
  - capacitor sizes
  - temperature estimates for high-current parts
  - switching converter simulations, including power dissipation
  - tolerance/error analysis on analog signal conversion/generation

Please note that you must bring at least **15 copies** of your design package to the design review. For industry-sponsored projects you must bring extra copies for your sponsor. There will be:

- 1 copy for yourself
- 1 copy for me
- 1 copy for all other project groups (there are 13 groups in total)
- additional copies for your project sponsor

## The Presentation

The format of the design review will be as follows:

- Your group will present a 15-minute professional presentation (using overhead slides, PowerPoint, etc.) that includes a brief overview of i) motivation of your project, ii) functional requirements, followed by a detailed explanation of your design. It is expected that all group members participate in this presentation, speaking on topics for which they have had direct responsibility. The goal here is to present the design choices and to justify them.

It is *strongly recommended* that you practice your presentation several times to ensure your timing is correct and that you address all of the important points. There should be no mumbling, no awkward pauses, no confusion as to who is to speak next, etc. This must be a *professional* presentation. Pretend that you are pitching your project idea to a roomful of venture capitalists and \$4.7 million of funding depends upon these 15 minutes. Dress nicely (suits not required).

- The remaining project teams and industrial sponsors will have the opportunity to ask questions.
- I will ask questions.

Each group will have a total of 25:00.000 STRICTLY TIMED minutes from the start of the presentation through to the last question. This means you must be very well organized and be prepared to start your presentation immediately. There is no time to fumble in your bag looking for your USB drive, no time to download presentations from a web site, no time to wait for Windows to recognize the projector and switch to presentation mode (if you're lucky), no time to collate papers for handing out. You are expected to arrive with all materials ready to hand out and ready to present. It would be even better if you arrived early and copied your PowerPoint presentation to the computer's desktop for immediate access (or brought your own computer and made 100% sure you can switch to presentation mode IMMEDIATELY).

You will each be evaluated independently based upon:

- Your contribution to the presentation
- Your ability to answer questions directed to you
- The quality of your presentation (as a group)

You will receive ample consideration for asking good, thoughtful questions when other groups are presenting their designs. Participation in the design review process is expected. Part of the reason for the design review is to improve your project, and you should expect that the questions that are asked of you ultimately lead to suggestions for improvement.

## Pitfalls

From previous experience, here are things you can do wrong:

- Forget the basics.

Remember how "the block diagram" was a central part of your Functional Specification? It is a great way to provide an overview of the project and should definitely be shown to the audience. Remember: you know your project's requirements, target environment, etc. but there are people in the audience who know absolutely nothing of this. Take the time to explain the basics. And there should really be TWO block diagrams: one showing how your product fits into the system as a whole, and another showing the innards of the product and its interfaces.

- Waste time on irrelevant details.

15 minutes is A VERY SHORT TIME to present a full design. You must spend time only on non-obvious design issues. Does your design have a reset button? Good. So does everybody else's. This is not something you have to justify. Don't even mention it.

Every design has just a few "tough" design problems that do not have obvious solutions. It is these problems that you must focus on.

If you're not sure what is important and what is irrelevant, ASK!

- Present illegible schematics.

If the person sitting in the audience can't make out a schematic on the projection screen, it's useless. Your presentation should zoom in on relevant parts of the schematic so that they are easily legible from the audience. Your printed materials will include the full schematic for reference.

And for heaven's sake, don't throw up your bill-of-materials onto the screen. Nobody will be able to read it. Make sure, however, it is easily accessible in your handout.

- Be unprepared.

If you don't know what you're doing, it will be painfully obvious. Don't try to fake it. If you don't know, you don't know. Admit defeat and move on. And above all, don't try to lie or worm your way out of a tough question.

- Be wrong.

Double-check all of your design calculations. Preferably, have a different team member do it. Nothing is more embarrassing than "justifying" a design choice when it turns out your computations are incorrect and in fact your circuit won't work.

- Read your slides.

A PowerPoint (or similar) presentation should have very little text. If you feel compelled to put text on a slide, ask yourself why you can't just speak it. Write it on a cue card instead and bring the cue cards with you. The slides are for VISUAL support of your presentation: schematics, sub-circuits, graphs, equations, flowcharts, block diagrams, code fragments with timings, etc. A slide with nothing but text on it is a waste of time. People can read faster than you can talk and by the time you're halfway through the slide, they've already read it and are waiting for you to catch up.

Equations are perfectly OK...but don't overdo it. If you have a lengthy derivation, the results belong on a slide, the body of the derivation belongs in the handout.

Your first slide is always a motivation for your project. Don't just write out the motivation. Draw a diagram that shows your project in its target environment and point out how your project fits in.

- Forget to provide motivation for your derivations.

Why are you launching into a justification for power consumption? Was this a requirement for your product? Is it a concern? Proving that your device will never exceed  $54^{\circ}\text{C}$  in normal operation is pointless if the audience doesn't know that this is somehow important.

Make sure the audience knows WHY you are presenting what you are presenting before you present it.

- Fall asleep.

One of the major points of this design review is so that you can see what your peers have done. There is a little bit of "survival of the fittest" going on here. If you choose a \$5.39 DB9 serial connector and another team has found a \$1.29 identical part, this is something you will have to change. I will expect that you LEARN SOMETHING from everybody's presentation, and this learning is reflected in the improvement of your own design.

- Fail to take notes.

If an audience member makes a good suggestion or finds an error, it is INEXCUSABLE to not reflect this in the next version of your design. This means that you must be PREPARED TO TAKE NOTES and you must actually TAKE NOTES when comments are made. Just nodding your head and saying "Good idea" is not enough.

- Don't spell/grammar check.

Nothing says "I threw this together last night at 11:00 PM" more than blatant spelling and grammar errors. This does not inspire confidence in your sponsors. For you to convince them that you have done thorough design work, you have to demonstrate that your commitment to quality extends all the way down to spelling and grammar. This includes both your handout materials AND your slides.

Spelling mistakes are bad enough on their own. They are much worse when they appear in big letters on a big projection screen, eliciting snickering and laughter from the audience.

- Be nervous.

Everybody gets nervous when they present in front of an audience. That's expected. But you must not be so nervous that you become inaudible, unintelligible, or stammer so badly that you use up your whole time. The audience makes allowances for some nervousness, but only up to a point.

So how do you overcome nervousness?

- Practice, practice, practice
- Have supreme confidence in your knowledge and in the correctness of your presentation (but note that the former without the latter is a recipe for disaster)
- Use cue cards

- Stare at your slides.

Face the audience, talk to the audience. At all times. You should already know what's on your slide. Never look at your slide! You are having a DIALOG with the audience, and the slides are there for visual SUPPORT. They are looking at you – you need to look at them.

- Goof off.

When you are NOT presenting but another team member is, you are to be attentive and unobtrusive. This is not the time to take a phone call, eat a bagel, sit down and grab a few winks, talk to your friends, etc. Stand there and be ready to answer questions.

- Go nuts with PowerPoint.

You know all of those nifty features in PowerPoint like fades, dissolves, swishes, etc. Turn them off. The focal point of your presentation is THE CONTENT. Nothing should distract from this, including:

- Fancy backgrounds – use something plain. That weird swooshy blue thing on a dark-blue background is annoying. Choose a solid, non-bordered, non-decorated background like a light tan.
- Fancy fonts and colors – use Times Roman for text, Courier for source code, perhaps one more font for annotating diagrams. That's it. Nobody will be impressed with your ability to navigate the Font Chooser dialog.
- Effects – they get really old, really fast. No fades, no dissolves, no letters flying in from the right side of the screen, and if ANYBODY uses pointless audio effects in their presentation they are GUARANTEED to receive a pre-completed change-of-major form.

## Final Notes

- The design review is a GOOD THING. It subjects your design to the scrutiny of lots of intelligent people that can find mistakes for you. Everyone in the audience wants you to have the best project possible and is indeed trying to help you. Take advantage of the help, and make it easy for them to help you. This means being well prepared and communicating clearly and effectively (both orally and in print).
- “Defending your design choices” does not mean defending them to the death. If you think you are right and the audience member is wrong, stand your ground (politely) and defend yourself with FACTS. If you are wrong, accept the fact that you made a mistake, thank the audience member for helping you with your project, and move on. If you don't have the facts, do not try to defend your design choices, instead promise to investigate further (and actually do so).

- You are expected to invite your project sponsor to the presentation. I want to be copied on the e-mail you use for the invitation, and I want to see this e-mail by the end of today. If your sponsor has time constraints on attendance I will do my best to accommodate them if they let me know in advance.

Please do NOT address your sponsors as “Dear Sponsors” in your e-mail. They have names – use them.

- Do not skimp on the Motivation/Background part of your presentation. 90% of your audience will have NO IDEA of a) what your project is, b) why it’s needed, c) what the existing solutions are, d) what the fundamental technologies are, etc. You have to dedicate time up front in your presentation to provide this context else you will lose your audience for the whole remainder of the presentation. Budget a solid 4-5 minutes just on this Motivation/Background.

I cannot overemphasize this enough. Every year I see presentations that fall completely flat because nobody in the audience knows what you are talking about. It’s an uncomfortable 15 minutes.