

## **University of Arkansas Microelectronics-Photonics Graduate Program**

### **PhD Candidacy Exam – Communications Topic – March 19, 2010**

#### **PROBLEM TO BE SOLVED**

The current debate over funding and administration of health care at a state and federal level has underscored the need for improvements in cyberinfrastructure that facilitate diffusion of advances in preventative, diagnostic, therapeutic medicine to patients, particularly those in underserved communities such as economically disadvantaged inner cities, remote rural areas, and members of underrepresented minority populations that lack adequate representation among health care providers. Another underserved community to consider might be persons who require critical or long-term health-care intervention, but lack health insurance coverage.

You are CTO of a company that specializes in environmental sensing and worldwide secure data transfer, storage, and analysis. The CEO of your company is interested in using your background in nano-micro materials, devices and processing to understand and then leap-frog recent advances in cost-effective, low-power, sensing, computing, and/or high-performance wireless technologies to develop integrated cyber-physical infrastructures.. Such an infrastructure would facilitate robust, accurate monitoring at micro (personal) and macro (societal) levels to accumulate personal physical data and/or community health statistics. It would allow secure database storage of information to support scientific research and critical analysis, and would permit continuous improvement to allow innovative healthcare services. Such an infrastructure would improve information flow from the physical (body) to the cyber (broadband and computer) world and allow capable management and processing (retrieval and analysis) of large volumes of information such as patient data.

Your proposal is expected to develop a cost-competitive, practical improved cyberinfrastructure at the level of material, device, or information processing that addresses a critical health care need. Infrastructure components that prevent, diagnose, or provide therapy to underserved communities are encouraged.

#### **YOUR DELIVERABLE**

Your task is to write an internal proposal for your corporate officers describing your approach to this issue, with clear specifics on such things as what specific aspect(s) of this problem you feel your company should address, and what market(s) your proposed product(s) should target. . The proposal should include the following:

- Executive summary (one page)
- Risk assessment roadmap form (one page)
- Full proposal (15 pages maximum)
- Appendix A: Bibliography (no page limit)
- Appendix B: Ranked list of intellectual property documents examined (no page limit)

Be sure you address at least all of the following:

**Current Science and Technologies** - What is already being done in this area by other researchers, companies and governmental institutions? The current state-of-the-art for both the science and the implementation should be described, making use of diverse resources such as science literature, journals, industry publications, conference proceedings, the internet, patents or other sources of existing public knowledge. **Be sure to cite all references that you use and to quote any word-for-word transfer to your report.**

**Your Design Approach** – What is the basis for your chosen design approach to the problem? Address why your product is better than the existing product solutions and what product attribute(s) allow suitable market penetration for profitability. Be sure to address both the scientific and engineering issues of the question.

**Testing and Qualification** - Describe a set of tests and demonstrations that you will use to demonstrate the effectiveness of your approach and to give confidence that the implementation of the solution will launch successfully.

**Cost Analysis** – Detail the cost and market issues that will impact the pricing strategy of the solution you have proposed. Because the CEO is concerned with potential IP leakage if a device is built outside of the company, subcontracting of the manufacturing or assembly of any proprietary component outside of the company is discouraged.

For instance, your analysis could include such things as the major cost items that would impact the implementation, which elements of your implementation solution would be handled in-house versus externally-sourced, major risk elements that could drive up costs if the primary path item fails, costs of IP licensing needed, etc. For anything you address, be sure to include not just the “what”, but also the justification and/or reasoning behind your decisions. Remember, the marketing team needs a good manufacturing cost estimate for the total system as the product reaches mature product stage in order to determine potential market size.

**Intellectual Property** - In Appendix B list in rank order of importance all commercial, academic, and governmental IP sources that were consulted while formulating the answer, including key important reference data. For instance, if the IP source is a patent, include the patent number; title; inventor name; and assignee name. The top three items in your ranked list should be discussed within the 15-page document, making comparisons of strengths and weaknesses of these approaches relative to your own. Include your recommendations on how these IP threats should be handled.

**Most importantly** - this is just a minimum list of issues you might consider. There may be many more. The point is that your report ***should contain the evidence*** needed to make an effective and compelling case to your CEO in order to insure that she makes the right decision.

**Hint** - Your report should read like a story – one logical step followed by another. This will help you stay focused! Re-read along the way to be sure that you have one logical step followed by another.