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Wired Versus Wireless

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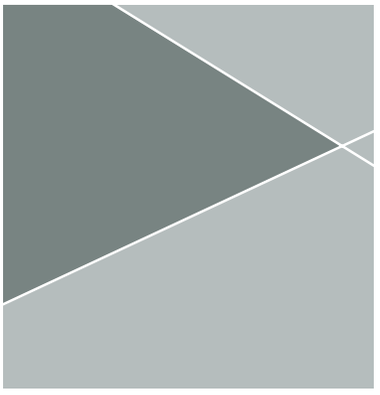
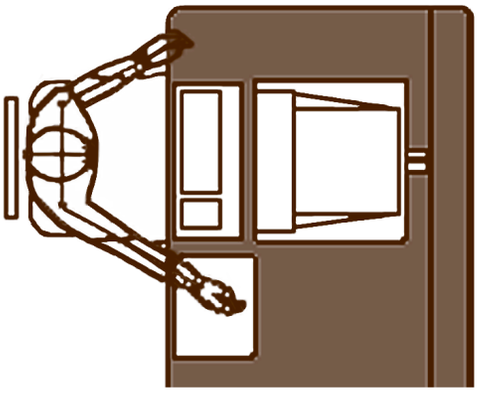
PEB Exchange Programme on Educational Building

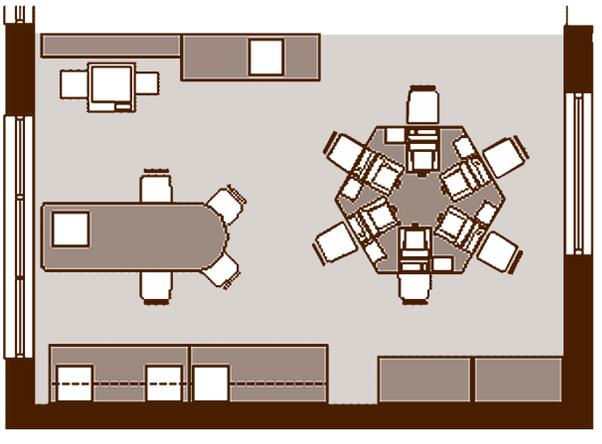
WIRED VERSUS WIRELESS

What follows is an edited transcript of an interview with Glenn Meeks and Prakash Nair by Randall Fielding, U.S. architect and planner, contributing editor to "School Construction News" and the editor of "Design Share".





Billions of dollars are being invested in wiring schools for desktop computer networks. Laptop computers and wireless networks offer an appealing alternative, promising greater access for the learner and reduced infrastructure. Glenn Meeks and Prakash Nair debate the issues. G. Meeks is President of Meeks Technology Group in Cary, North Carolina, which helps educational organisations with technological planning and implementation. Prakash Nair is President Elect of Urban Educational Facilities for the 21st Century (UEF-21), New York City, an organisation committed to the development of urban educational facilities that provide the best possible learning environment for children.



R. FIELDING: Prakash Nair made presentations at the CEFPI and UEF/PEB/CAE conferences in Baltimore last fall, putting forth the notion that schools would be better off investing in laptops and wireless networks rather than wiring classrooms for desktop computers. What is your opinion on this approach?

MEEKS: I agree with Prakash Nair that in terms of mobility and access, laptops are great. But in terms of value for your money, I do not agree. Meeks Technology recently planned a high school in Allen, Texas, with a footprint of nearly 500 000 square feet (45 000 m^2). The bid for a hard-wired network came in at USD 1.5 million; the system included 5 600 data/power ports, spread throughout the building, with an electrical outlet and 100 megabytes per second network transmission capacity at each port. An alternative bid for a wireless system came in at USD 3.5 million; the system included 200 to 300 transmitting hubs, delivering 10 MB per second shared capacity at each node.

The curriculum calls for students to present assignments using multimedia tools, with files often exceeding 15 MB – too large to work effectively with wireless technology. The wired solution offers ten times the capacity at less than one half the cost – an easy decision for Allen High School.

NAIR: I predict that, two years from now, this debate will look ridiculous because advances in technology will make wireless communications in the classroom the only sensible choice in most situations. Costs are changing rapidly. Whereas the Allen High School project was bid with PC transmitting cards that cost in the USD 350 to USD 500 range, a WaveLAN card, developed by Lucent Technologies, is now available for USD 179.

RF: Your argument for laptops and wireless networks is particularly compelling for renovation projects, where the costs of opening walls and expanding the electrical power infrastructure are greatest. Do you have the same opinion for new construction?

NAIR: I would definitely propose that all new schools consider wireless first. Getting into the actual technology solutions for a minute, let us take a hallway in an old school with eight classrooms in a double-

loaded corridor. One option is to fully wire two of these classrooms and equip them each with 30 computers. Under this scenario, the remaining six classrooms will not be computer enabled.

Assuming that this same corridor has four wireless hubs installed with overlapping coverage, any two unwired classrooms equipped with wireless cards can be simultaneously on the wireless LAN, each receiving 20 MB per second of data. Since the LAN itself is only used to communicate with the Internet or send messages to others on the network, this data-transfer rate or bandwidth is more than adequate.

I believe that the economics for wireless computing works in new buildings as well. I am a proponent of wireless computing not simply because of the economics, but because it provides the least intrusive and most flexible method for bringing computers into classrooms and into school.

RF: How is it possible that wiring for hubs in key locations can cost twice as much as wiring all classrooms?

MEEKS: One wireless transmitting hub for every 1 500 to 2 000 square feet (150-200 m^2) is required. For Allen High School, this resulted in 200 to 300 hubs. In this case, we had steel floor construction; hubs cannot transmit through steel floors. Each hub itself costs USD 985; add to that the cost of the card at the transmitting location, plus the cards in the laptops themselves. You also have to consider the power requirements to charge hundreds of laptops. The battery life before re-charging is about two hours. You need charging stations or mobile charging carts with a large capacity.

You also need to consider the long-term costs. Desktop computers are often used for five years and longer in schools; when a hard drive breaks down, it can be replaced economically. Laptops typically cost twice as much as desktops for the equivalent features; the typical life span is two and a half years, and if a hard drive breaks down, it's not economical to replace it.

Another factor to keep in mind is the global limitations of bandwidth. Wireless networks are undergoing explosive growth, and there is simply not enough bandwidth to accommodate it. As processor speeds and hard drive capacities have increased, so have file sizes, and this trend will continue. There is no technology on the horizon that will allow wireless networks to catch up with the bandwidth capabilities of a wired network.

RF: There is a good deal of research and literature that questions the value of technology for learning, or at a minimum, advises a good deal of caution. Clifford Stoll writes: "No computer can teach what a walk through a pine forest feels like. Sensation has no substitute." Please comment.

MEEKS: The ability to manipulate information is the key to economic success in our society. Technology is actually increasing the gap between the haves and have-nots. It's critical that our schools teach computer skills in order to level the playing field.

NAIR: We need to find the best way to integrate technology into the curriculum – and I am not talking about the obsolete idea of computer labs. Also, the popular practice of putting one, two or four PCs in a classroom is a dumb idea. It takes away valuable space in already overcrowded classrooms and does nothing to integrate computers into the curriculum.

From my own observation, I know that a computer in a child's hands can become an instrument for learning – particularly in poor, urban areas where computers and the Internet can bring a wealth of information resources to children that they would otherwise not have access to. For computers to be meaningfully integrated into the curriculum in schools, I am convinced that two criteria need to be satisfied:

First, kids need to have access to laptops or some other portable computing device if not full time, then for some significant period of each school day. I say portable device because the computer should be usable as a tool to enhance learning English, social studies, geography, math or even music. It should be available when needed and out of the way when not needed – like a pencil. A PC is simply not suitable in that context. Second, kids should be able to have structured access to the Internet, to supplement the work they do in class, in the library and at home.

Conclusions

Laptops and a wireless network provide the most access and flexibility for learners. For renovation projects, particularly in cities with high labour costs, laptops and a wireless network are more economical as well. For new construction, a hard-wired network with desktop computers is currently the most economical installation and affords greater bandwidth for large multimedia files. Data on the future costs and bandwidth capabilities for wireless networks are inconclusive.

My opinion is that computers should be de-emphasised or left out altogether from elementary education. Research from numerous sources indicate that

computers for children under ten years of age are more likely to do harm than good. My own experience bears this out. I recently attended a student display at my daughter's elementary school. The preponderance of computer-generated graphics was astonishing but sad; there was a sameness about it all. A small minority created their own graphics – crude, colourful images – displaying creativity unmatched by the computer-generated materials. Young children should learn to use their hands, eyes and voices – there is time enough for "professionalism" in later grades.

Both G. Meeks and P. Nair assume that a fully accessible central network is critical in schools. I question this assumption. School is an ideal place for collaborative learning, social interaction and face-to-face involvement with teachers. Continual access to a local network or the Internet are not necessary and may be at cross purposes with the interactive potential of the school environment. Utilising laptops, middle and high school learners can connect to the Internet at home and on a part-time basis in school. A limited number of students can connect to a local network for presentations and file sharing at any given time. Students can charge their laptops at home or in a library carol. Two hours of laptop use a day in school is sufficient for a balanced learning programme. A limited number of charging stations in classrooms can accommodate the exceptions. This approach would eliminate many of the costs associated with electrical and network wiring.

Constant access to high bandwidth connections for transmission of multimedia files is not critical. Word processing, spreadsheets, and most Web site design, drawing and image editing can be handled effectively with laptops. Full motion video and processing of large, high-resolution files can be handled by a limited number of "mission critical" desktop computers in project labs.

An academic "house", with a common resource area, surrounded by a group of classrooms for related age groups has merit, but designing it for 25 to 30 computers seems short-sighted. A school building will likely be around for 40 years or more, but the integration of computers in curriculum will surely go through radical changes in the next ten years. A better model for a common area is a flexible project space, with electrical power for computers and other equipment, flat tables for projects, a sink, small library and space for group meetings.

For an on-line version of this article in its entirety, see http://www.designshare.com

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CORRECTION

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