User Scenarios for Equity Access to Educational Resources

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Introduction

Direct Broadcast Satellite (DBS) implemented in the form of Digital Data Broadcast (DDB) "carousels" can be used to provide a solution for equity access to educational resources. As described in several EduPort research reports available through the EduPort Home Page [1], this solution can provide universal and global education services and applications that can be deployed alone over the broadcast infrastructure, or as a complement to the Internet. The solution can leverage content that has been developed for the Internet, as well as other educational material, from text to rich multimedia. The focus of this paper is on the user scenarios that are enabled by the EduPort/DBS infrastructure.

Background

A new broadcast system for true equity access and quality content can become a powerful and efficient educational infrastructure, that can be deployed at moderate cost, and can reach remote locations with or without coupling with the Internet. It can turn the huge interest that young people have on television into an educational force. For this solution, the use of digital broadcast was anticipated for the purpose of global reach, the growth of the Internet taken into consideration, and the Web used as the standard for interacting with content. But, unlike the point to point connectivity model of the Internet, the digital broadcast medium can be used in real-time or in download mode to broadcast, multicast, and PointCast a set of educational material and content.

Methodologies to capitalize on the broadcast medium also include the use of cable and wireless broadcasts called "wireless" cable. Broadcasting can fully complement access to the Internet or can be deployed stand-alone. With the infrastructure in place, the investment required by a school can be as low as a single PC or TV with a Digital Set Top Box (DSTB). This makes the infrastructure feasible and physically accessible to students anywhere, even from their homes.

The following are the delivery options available to the EduPort/DBS Infrastructure:

Option 1: A single stand-alone PC or TV client with access only to DBS.

Option 2: A single PC or TV client with access to both DBS and the Internet.

Option 3: A PC or other Gateway/Server connected to DBS, which in turn enables an intranet within the school to interconnect to a set of PCs via a LAN,

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The following scenarios were created to illustrate those options.

Option 1 Scenario: A Rural Community in New Mexico

An important criterion for equity is minimizing cost while maximizing access. Nobody is more aware of that than the people of Capitan, near the Mexican border in New Mexico. Their pretty adobe school, while well equipped in many ways, is not yet part of the 50% of Internet connected schools. It is, however, home of a dedicated teacher, and a well used TV set. Educational programs made available over public TV have always been a part of community learning. It is the one, always-available resource.

Television plays a large role in the education of the Capitan community. From news, to weather, to local culture, including picking up programming from neighboring Mexico, all members of the community synchronize to the content available from their TVs. Joey Lopez is no exception, but he would prefer to use the TV for entertainment. There is no TV in his home, but one of his great goals in life is to save up his own money to buy one for the family. In the meantime he does enjoys the educational programming that he can watch in school.

By the time he enters High School and is able to earn and save money for his dream TV, technology innovations will have changed his plans. Joey's geographically isolated, but extremely important school, is about to leapfrog into the future, taking Joey with it. A small satellite dish was installed over the weekend where an antenna used to be. Inside, a large screen TV equipped with a DSTB has replaced the modest TV set. The total cost to the school was under $3,000. Not even the available State grant was needed to purchase this first EduPort/DBS access facility. A businessman from a neighboring town, who at one time sat in Joey's classroom, donated the equipment.

It is Monday morning and Joey is earlier than ever for school. He decides to compete for first row sitting this morning, although that turns out to be a challenge. Not about to compromise, he sits on the floor right in front of the TV. Ms. Gonzalez, his teacher, picks up the remote control and selects channel 127. She double checks with the community education playlist, a sort of educational TV guide that she received in the mail. Channel 127 it is, and between 9 and 10 AM the "Matter and Energy" disk will be on the air. Literally in the sky, the disk contains interactive material, similar to Web pages, covering educational benchmarks that deal with alternative sources of energy.

She moves through Web-like pages on the screen using the remote control, discussing the topic as images and text appear on the large screen. She watches the corner of the screen where a countdown is taking place in a small box. When the number hits 1 she selects channel 128, just as the number in the small box moves to zero. A video clip from "Terminator II" grabs the students' attention instantly. It is part of a short educational module from the American Chemical Society that discusses nitinol, a substance that changes shape when exposed to heat. Ms. Gonzalez had a chance to preview the content over the weekend. She knows that an expert, a scientist, will soon explain how nitinol works. She lets that part of the video play and then stops it with her remote control. Joey and others complain out loud. They fear that they will miss the rest of the program, but Ms. Gonzalez assures then that is not the case.

At this point, having prepared this lesson with great care, she pulls out a piece of nitinol wire that came with the program guide. She twists it to many shapes and then dips it in hot water from the

school teapot, also made ready for this event. The wire instantaneously returns to its original straight shape, not a twist in it. The students ask why, and she reminds then of what the scientist on the TV has just said. But they can do better than that, they can explore the potential of nitinol and the principles associated with the transformations of matter and energy by interacting with the content that is on the disk in the sky, as if it was a CD-ROM in a computer.

They will all get a chance. There is only one remote control and only one education port (on this day), so the students learn also to collaborate. They move through the content by deciding what link to click on, Joey does the clicking this morning. After about 15 minutes of these interactions with the material, Ms. Gonzalez gets the remote control back and plays the American Chemical Society clip again, just as that number in the little box was about to hit zero. It takes 1 second for the clip to start, playing the short "program" from the very beginning, again, like magic. Joey, who is not growing up believing in magic, must see this gain. He claims that he missed a part of it, and asks Ms. Gonzalez to "play it again". She clicks back to channel 127, interacts with some pages on the screen, as she re-enforces the lesson, one that they will now never forget, and changes the channel to 128 as that little box hits zero again. The Terminator II clip appears followed by the scientist, whose explanation has by now been ingrained in the minds, and imagination of the children. They will also never forget how to us this system. If he only had this thing at home, what a way to do homework!

The Matter and Energy Lesson will be on the air for another 20 minutes, but it is time to open the books and do some additional work. Especially Joey, who does not have a dish, does not take this kindly, and TV set at home. Joey will not be able to review the material later that day from home, but already several neighboring homes are planning to share the cost of a learning port. It will be hard at first, but all of the students in Capitan are well on their way to quality and inspiring educational resources, coordinated with what is taught in school, all coming from coming from their TVs. Now Joey is more certain than ever about saving for that dream TV, but he now has different ideas of what he will rather use it for.

In the meantime, the day is not over. At 10AM the geography disk will on the sky, and at 11 it will be Chinese. Spanish is not a foreign language in Capitan, so Joey will really have work on Vocal Tones, the Chinese lesson. His Mom however, who has no desire to learn Chinese, will be learning about Matter and Energy in Spanish, if she is able to come to the school this evening. All the broadcasts carry two audio tracks. In Capitan the second audio track is in Spanish, This makes it possible for much of neighboring Mexico to take advantage of this educational resource. But it wouldn't be long before the cultural exchange is reciprocated.

Option 2 Scenario: In a New York City Apartment

Mary's parents are both at work. She typically comes home from school and turns on the TV. In mid-afternoon many soap operas are still on the air. Mary watches them occasionally, mostly to joke with her friends about then the next day. It is mostly the talk shows that grab her attention. She particularly likes the ones where parent and child air their problems on public TV. Her homework gets put off until the shows are over, then her parents come home, it is diner time. She does some homework after dinner, but she gets a few phone calls, she starts to get tired and falls asleep. Homework is incomplete, the story of her life. She often wonder how her friends with brothers and sisters competing for privacy, TV and telephone time can get any school work done at all. They don't.

Mary is very lucky. Her parents not only can afford to provide her with her own TV and telephone, but she also has a computer and an Internet account. That was the real reason for the extra telephone line, although she uses mostly for real, not virtual, chatting. While homework continues to be somewhat of a nuisance, looking things up on the Internet is more of an adventure. She enjoys all of the assignments that require surfing the Web. Unfortunately not enough of those are required because not every student has personal access to the Internet. Most of her teachers limit Internet searches to what might be reasonable to do from the computers labs in school during free periods.

On weekends Mary spends a fair amount of time surfing the Web, but without a coherent school-home Internet curriculum in place, it is not possible to harness that resource properly, so she wonders off on cyberspace. Mary ends up misusing the resource, much in the way in which she misuses the TV and the telephone. The Internet has become another form of entertainment and accounts for a great deal of wasted time, and money. Her parents are not sure what she is doing on the Internet, and they are concerned about content quality and safety issues. This evening at the School Board meeting Mary's parents plan to raise those concerns.

It turns out that they are not alone. Many parents with similar life-styles and resources share their concerns. They are all aware of how EduPort/DBS is being used to bring quality educational content to inner city schools, not unlike what is being done with the resource in rural areas. But in the more affluent neighborhoods the EduPort channels are not really needed in the classrooms, where there are many teachers with specialized skills for every subject, and many computers with CD-ROM drives. The point is, Mary's parents argue, why can it not be used as a school-home "work" resource by coordinating curriculum with educational broadcasts, they way it is being done in New Mexico, for instance.

A communications engineer is present this evening and he has a better idea. With an Internet connection used as return channel students and teachers can request specific materials to be put on a particular playlist for the school district. A separate access channel can be used to distribute the content over a given time dimension. The engineer noted that in combination with cable provided public access channels, EduPort/DBS could be used by students, like Mary, with their own Internet line as return channel, to do research, perhaps collaboratively with other students, using the medium to request material for download to their computers. Many teachers started to think that this would be a good thing to do for the classrooms too. Perhaps they too had been wasting a valuable recourse showered upon them constantly, and underutilizing the Internet connections they so lobbied so hard for.

For example, Mary's Art teacher can, using her Internet connection at home or in the school, request that a virtual exhibit of Picasso paintings, with associated textual links, be broadcasted during various time spans, the times when she is teaching the Cubist art form in several schools in the district. Since the broadcast medium provides sufficient bandwidth to view the images in real-time, without the expense of download connectivity time, Mary will be able to examine all the artwork, and explore all the issues using her PC. Mary already has most of the equipment that she needs to access the broadcast data from her PC or even the TV in the living room. Mary's father treated the family to a small dish and set-top box for entertainment. Little did he know then that his new entertainment center would open a widow into his daughter's classroom. Now he'll understand how much work I have to in school! Let's see how much he knows about Picasso! Mary reflects on the positive aspects of this new form of participation by her parents, a deep inside she likes the idea.

But, the discussions of the board meeting were not exactly music to Mary's ears, especially since her father who unpacks and installs the dish - the following morning quickly turns them into action. She is aware of the fact that such dedicated transmissions could cut into her talk shows. While specifically chosen for her district, interactive, and real-time, the content would be available only during given broadcast time spans, mercifully repeated often over several days. And, because they are connected with curriculum, they would be as much a part of her homework assignments as any other work she is expected to do. This is not so though, she thinks. However the curriculum will get much tougher, Mary's teacher promised at that fateful board meeting, and she's one to deliver!

Option 3 Scenario: A Science Coordinator Plans Ahead

Mr. Teller is quite an expert in communications. Before becoming a High School teacher he was chief engineer for a city TV station. He has long moved to suburban Connecticut where he coordinates science and technology for a school district, and from time to time helps out at the neighboring Talcot Mountain Science Center. From a hilltop, this facility broadcasts educational programming to several surrounding States. Talcot TV just went digital. Mr. Teller had his hands full during the conversion, but he is now about to rip the benefits of the hard work and investment at the Center.

The school where he teaches in East Haven is very digital too, and extremely well equipped. Each of 100 classrooms boasts a large screen TV and satellite dish. Each is able to receive and interact with, independently and simultaneously, the disks that are put in the sky by the Regional EduPort Serving Center in Hyde Park, New York. There is very little Mr. Teller has not thought of, when it comes to harnessing digital broadcast content. But, the constantly growing resources at East Haven are about to give him yet another opportunity; a new opportunity technology has to offer his students.

One of his schools has acquired a significant gateway server capable of storing 40 Gbytes of content at any given time. Using the server as the districts electronic reserve room, he created a local network, or Intranet that connects several classrooms and labs. He has also connected several of large screen TVs in the school to this network. His students are moving way ahead of the curriculum and he wants more content. He does not want to depend on the local, regional, or even the combined playlists of all EduPort transmissions in the US. He wants to individualize learning for each of his students. They all have different scientific interests. Tailored content is the key to keeping each flame alive; all of the available resources are not enough to do that.

Mr. Teller has arranged to use the significant digital broadcast bandwidth available to them every second of every day from the Talcot Mountain Center, for content download overnight, when there is not much broadcast requirement in the region. During the day scheduled standard educational programming as well as EduPort disks are constantly being broadcasted, filling up the available channels. But at night there is spare bandwidth.

The bandwidth used by a typical digital compressed video program (8Mbps) can be used to download 600 Mbytes of content in a 10-minute interval. At night there is spare bandwidth to service the growing needs of Mr. Teller's students. Conceivably, he could almost exactly refresh his 40 Gbytes hard drive server each night by tuning in to a single DBS transmission. That is not what he will typically want to do, as locating and scheduling the broadcasts and download this much data would require a diversity of sources of content. There is not that much digital content in our combined digital libraries (yet). But the big problem is the amount of his "extra" time that

this would require. Mr. Teller has more storage capacity and resources than time. So, for now, he will have fun refreshing some of the content in the gateway server once a week.

Mr. Teller and his students and teachers are pioneers in new frontiers of information, while at the same time breaking new grounds in science education. They will harness content by making efficient use of broadband in the schools, and they will show their peers how this is done. Someday, he is certain, and very soon, he hopes, every student will have access to 100 Gigs of tailored learning material from his gateway server using wireless laptops that they themselves will individually refresh to meet their own personal demands for information. Every student will follow his or her own dream, when access to learning resources is not a luxury, or a problem, but a way of - learning.

Option 4 Scenario: Clusters of Learning in South America

The Minister of Education of small South American country is a forward thinking man. He is determined to bring the schools of his small, much loved homeland, into the 21st Century, ahead of the US, France and England, or any developed or developing country for that matter. This is within his scope and reach of possibilities. Technology has made it possible for his country to achieve such a goal; all that is now needed is vision and leadership.

Communications and digital technologies will have to be thoughtfully engaged; and Dr. Saxe is not about to unwittingly pursue large-scale plans and massive Internet deployments without exploring all the options. He is concerned with sub-tropical flooding that often put phone lines and electrical services out of operation in all but his hemisphere. There are only 250 High Schools in his entire country, however, which is the size of a large American city. This geographic concentration makes it feasible to actually wire the whole country for broadband. That too is not outside the scope of what could, and is considering doing. Given his track record of success and ability to pay back, a World Bank loan has been negotiated. He needs realistic technical specifications and a long-term highly sustainable plan. He will spell out such a plan at some point in time, as soon as he has learned how to best deal with the flooding problem. For now he is much more concerned with content and establishing a world class serving center.

He had made plans to deploy a Regional EduPort Serving Center for that harnessing of content in digital library form. He is now thinking of merging those plans with a digital TV broadcast center that will be used strictly for education. It will make available interactive data carousels during the day, and be used for downloading of data to local gateway servers at night. He got that idea when visiting the Talcot Mountain Center, in the US. A team of students from the main university in his country has been working with a science teacher in Connecticut to perfect that plan. In the process they have managed to strike a deal with Talcot Mountain for the mutual exchange of educational MPEG content which they can use right now.

While full deployment of wired connectivity to every school and home is still in the drawing board for this ambitious leader, he understands well that content is the real key to success. He must prepare to provide digital educational content in a form that will be ready for deployment in both the fully wired and broadcast modes. Neighboring countries with fewer resources to support a large serving center will be able to leverage his investment, taking advantage of his visionary plans. Deployment of the user infrastructure (satellite dishes, set-top boxes, and TV sets) is a possibility for many countries in South America. Mandatory education in Mexico was originally made possible through the deployment of educational television. South America is well aware of the value of these technologies. Sharing a common language unifies and completes the

feasibility of the plan for the continent at large. A global solution makes sense where collaboration multiplies the options for all, and is desired by all. The solution Dr. Saxe saw in Connecticut can work stand-alone or to complement any other infrastructure. Planning carefully he sees that while the broadcast model may be to broad (geographically) for his country, it is more economical in the long term, and does not exclude the possibility of exporting information and providing those services as a form of commerce. Every nation, no matter how small in size, can be big in ideas and influence every other nation. Every leader wants to do just that.

What is the Vision?

Equity access is the only road to civilization. Solutions that produce differential results hold everyone back. In the 21st Century everyone means everyone in the world. Digital technologies, not CNN or Wall Street, have turned the world, for the first time, into a global society. But it is the content that we see on CNN and harness in Wall Street. The least common denominator in this global society is the TV set. The sky is free, and it is another thing we all share in common.

Can we not combine these axioms with digital technologies to achieve equitable distribution of educational resources? Can a child in South Africa, Harlem, or rural New Mexico not have the same opportunities for learning? Will these children be motivated to exploit these opportunities, if they were made available to them? Given that it is possible to find out what the answers are to these questions, can we play dice with the minds of our children, with our future? Who will take that responsibility? Who would take that chance?

Developing an infrastructure to provide access to a new class of educational resources from the TV set will not reach every student, will not motivate every student that it reaches, will not solve all of their problems. There are fundamental life problems that so many of the people we want to reach have to deal with, and they are not going to find direct solutions for them in what we will be able to give them. However, so many more, of those in greatest need for solutions to their fundamental life problems, will in fact be reached, that the effort cannot but create a ripple effect of change for the better by those newly reached, and newly motivated. A global education infrastructure will produce the kind of social revolution that our world has, so far, failed to get right.

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General Reference

1. The EduPort Website at http://ianrwww.unl.edu/eduport/eduport.htm