

Creating India's Largest Distance Education Infrastructure - a concept note

Nagaraju Pappu

pnr@canopusconsulting.com

<http://www.canopusconsulting.com>

<http://canopusarchives.blogspot.com>

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Introduction

There are about seventy million young people who will need employment in the very future. All these people need access to affordable and quality education. The existing capacity in the country is woefully short of meeting even a small percentage of that demand. Even the existing universities, colleges and institutions are already under severe capacity crunch. On the other hand, the cost of high quality education in India is very high to a large section of people - an engineering degree costs upwards of 3-4 lakh rupees currently. The quality of many private colleges - with the exception of a few reputed institutions - is very low. The capacity of the premier technical institutions like IITs, NIITs, IIITs is very limited. The stated objective of many of the premier institutions is to focus more and more on research. As a result the professors and academicians in these institutes are not able to devote themselves to the task of broadbasing their teaching content.

The only solution to this problem seems to be creating a highly scalable distance education system. Unfortunately, the government initiatives in this regard are mainly focused on literacy programs, and distance education in some social sciences - mainly post graduate courses. It is not far from the truth to state that distance education is primarily meant for house wives and government employees wanting promotions and increments.

Distance Education Vs Online Education:

In India, distance Education model is mostly driven by open universities like Indira Gandhi Open University and also by the distance education departments by some of the universities. These institutions have not yet made use of Internet and Technology to create virtual classrooms.

Online Education hasn't yet taken off in any significant fashion in India or even in the west. Mostly short term, independent, self study training courses are offered online. And the most successful online courses are mostly complimentary or fringe subjects. In the west - as an example - courses related to hobbies like photography, calligraphy, creative writing, self employment etc. are popular and successful online courses.

Basically, there is a fundamental difference between distance education and online education. The distance education model offers a complete degree or certificate and thus is driven by a university or institute that has the authority to issue a degree. The online education model is aimed at people who want to learn or acquire a new skill without any need for a formal degree or certificate.

The advantage with online model is its affordability and reach. Once a course is offered online - any number of people can join the course, and it can be offered globally. However, the current model of online education is not geared to assess the student's performance, cannot offer a fixed time period courses, and does not offer a class room model.

The limitation of distance education model is the quality of the content, courses and its scalability. The advantage of the distance education model primarily that it is a fixed time frame degree oriented program, it has a model assessment and it is a directed program.

If we can create a new model of virtual university that can bring together the distance education as well as online education, then we can offer an affordable, scalable educational model.

In essence we have to create a virtual university:

- That offers degree courses - directed courses.
- That offers a virtual class room model.
- That offers High quality educational content.

But how do we do it? [If our target is to create a platform that could be used by millions of students] we have to solve some important problems that are central to the virtual university

- Where and how do we find quality teachers?
- How do we create high quality course content?
- How do we create a class room atmosphere in an online environment?
- How do we create a very wide variety of programs?
- How do we deliver the content to a large section?
- How do we manage the large user base?

In the rest of the document, I provided some solutions, and defined the needs and means of creating such a platform.

A Personal Perspective

I work as a freelancer. I offer architecture and design consulting services to many technology companies. For the last five years, I have been spending a considerable amount of time teaching. I spend at least three/four months every year in teaching and training. I am a visiting faculty to IIT-Kanpur and IIIT-Hyderabad. I taught full semester courses and also conducted various short courses, workshops and training courses in the last five years. I spent lot of time and energy in discovering, exploring effective and efficient teaching techniques and methods. I interacted with many academicians, scholars, professors and teachers in this regard. Teaching assumes a class room ambience. Teaching is not communication of information and perspective, but at the core of teaching is transmission of techniques of understanding. Perhaps this is the reason why the personal contact with the teacher and student is very important. The real learning takes place incrementally through a process of discourses, illustrations, interactions and osmosis. The teacher also keeps a constant vigil on the student's learning ability and constantly modifies how he approaches the student. Teaching and learning is a journey - the teacher and the student walk towards each other.

As will Durant said - Education is the technique of transmitting civilization. In the last few thousand years, all the great thinkers of humanity spent their energies on how to make such Transmission efficient and effective. The various systems of education starting from the ancient eastern system of Gurukula Tradition to the modern day systems of large universities are all attempts at inventing, systematization of such a transmission techniques. We have not yet found a means of education without the discourses and personal contact between the teacher and the students.

However, as a Civilization we reached a state of unparalleled development with the advent of Internet and the associated technologies. The Internet made many things possible which could not have been dreamt of even a few decades ago. The Internet has become what some science fiction writers called the collective consciousness of humanity. The significance of Internet can best be summarized as follows:

1. It is the sum total of all the information available with the humanity.
2. It represents the 'state of mind' of the world at any point.

3. It is founded on the principle that everyone is a contributor and all have equal rights to the information available.
4. It grows and develops in Real Time. Perhaps it is the only system designed by human beings that has all the elements of the biological and evolutionary principles.
5. It is designed to be immortal and permanent. Philosophically, the 'Internet' has always existed in some form or the other, but today it reached a state of total evolution. Since it was never born, it will never die. The only human creation that is divine!!
6. It is the vehicle of all future information and content delivery.
7. Like all of the fundamental resources of the universe - it is totally free. No one person or group of people own it, control it or pay for it. Like the environment we live in, we all have a collective ownership and responsibility to it.
8. It assumes that all information already exists and focuses on connecting it.

This view of internet has not been presented till now. Mostly, the Internet is presented as bunch of computing technologies and a large repository of information. Such a 'technical' or limited view of internet was appropriate until a few years ago, but not any more. The 'web2.0' as it is termed today has changed, - or will change in the next few years - many things. The web2.0 brings together the important and fundamental design evolution to the Internet.

There are three fundamental design enhancements of web2.0. It aims to bring together a model of collaboration. The collaborative model allows people to Create, Update and Maintain content together. The wikipedia and blogs are just the beginnings of the collaborative model of the Internet.

The second design enhancement is a model of semantics. The current web is organized and connected very syntactically with no 'inherent' meaning preserved in the organization of the content. With Semantic web the underlying structure will acquire a 'knowledge' about its own organization scheme. This concept is a very subtle and deeply technical, but I will try and explain this as non-technically as possible. Till now the web is a collection and organization of information. It is like a network with several billion nodes and connections between these nodes. But the network itself has no 'awareness' of itself - it doesn't know what it is. It is the users who understand which node is connected to which other node and why. But the 'semantic-web' aims to change that. When the semantic web is fully realized, it will make the web self aware of its own organization. This means that the network 'understands' why some nodes are connected with others and the 'relationships' between them. This means that the Network knows- given a node - what other nodes should be connected with it - even the nodes that do not exist as of yet!!

The third design enhancement is a new definition of information and content. Systems Thinkers and Systems Philosophers like Robert Antony Wilson, Rusell Auckoff, Gerld Weinberg etc long ago understood the value of non-linearity. Knowledge is non-linear connection of information. For example, given any two pieces of information, a human being can connect them together in a unique fashion. A person's knowledge lies in the way he connects two pieces of information together. Till now, the information models of computing science were mainly linear, but the next generation of Internet aims to change it. The second change to the definition of content is the removal of 'text'/'language' as the only medium of storing and using content. Today's technologies bring together various other media - like sound, pictures and images - also as a primary content creation medium.

I believe that there is a need for fourth design enhancement which not yet mainstream concept of the web2.0. There is a need to bring together the 'semantics' of people who create and use the Internet. At present, the network has no understanding of the people and their roles/functions in creating and using the content. The current Internet design ignores the most important element of the knowledge of its users. There has to be another network - network of the possible roles/functions of people who create the semantic-web, and this network needs to

be embedded into the semantically organized information network. At present, since the semantic distance between different kinds of users are not maintained, every one tries to serve the ultimate end consumer. But in a true collaborative model, one produces a service for the consumption of his nearest neighbor. This is the only way the 'chain of production' really works. Consider the way electricity is produced and consumed.

- The electricity generation process does not produce electricity for the ultimate end user/customer. It produces electricity in a manner that is meant for the distribution process. The distribution process distributes the electricity without any regard to the way it is generated. It does not make any distinction between whether it is generated using a nuclear reactor, Hydro-electric turbines or coal/gas turbines. No one else other than the generation process cares about the source, process and technology of the generation.
- Similarly the distribution process uses its own complicated technology, process and tools to efficiently distribute the electricity.
- The electricity appliance manufacturing does not care anything about either the generation or distribution process at all. It focuses only on the efficient manufacturing process of the appliances and its application. In fact, the only concern - as far as electricity is concerned is whether the appliance has an efficient power usage model or not.
- The interface manufacturing process - like wiring, switches and plugs does not concern itself with generation, distribution or the appliances. It focuses only on the efficiency of its own process.
- The ultimate Customer does not concern himself about any of the above. In fact, he does not care anything about electricity at all - but only its effects.

If we carefully analyze the above analogy we can draw many conclusions:

- Every one in the chain has a different function, process and technology that is unique to their field of operations.
- Every one in the process delivers a service to their nearest neighbor. If the generation process tries to deliver electricity directly to the ultimate consumer - the power technology today would have remained very primitive.
- The entire chain works on certain standards and protocols.
- Everyone in the chain has a unique, well defined problem to solve which requires very different kind of expertise from one another. The recognition of this fact is central for a successful collaboration.

The reason why we explained the principles of Internet and Service Delivery in this note is because these principles form the bedrock of the distance education platform that is proposed in the next few sections of this document.

In summary, the various drivers of the distance education platform are:

- There is a large student population that requires access to high quality, affordable education.

- The current capacity and the present educational model cannot scale up to meet such large scale demand.
- We have to create a new model that brings together distance education and online education.
- We have to use the principles of Internet and Service delivery to create a scalable platform primarily because it is the only model that provides the kind of scalability, cost effectiveness and content creation and delivery.
- We cannot 'create' and 'own' the community ourselves, therefore we have to work with the existing community and find ways and means of connecting them together and give them an environment that allows them to be much more effective and efficient.

The Community

The communities of people who are needed to create any sustainable environment are in general fall into three groups - the domain experts, systems experts and process experts. In our model of virtual university - the domain experts are the researchers, scholars and teachers, the systems experts are people who create the environment, platform and framework, and the process experts are people who create the workflows, and the underlying operational, and systems level processes and tools.

The domain experts

The domain experts in the context of education are the researchers, scholars and teachers. Even though in general, we do not tend to make any distinction between these groups of people, below I tried to present the differences in their function using a familiar analogy.

The Gardeners

There are institutions and teachers/researchers who create the 'knowledge base' awareness. This results in course curriculum and course content. Institutes like IITs and the people who work there fulfill this role. When IITs were created some forty years ago their mission is to make 'engineering & technical education a main stream activity in India. Today, because of these institutions an engineering degree has become a commodity product in the country. Because of their role as pioneers and thinkers, these institutions cannot scale up - they need a small section of student community who participate in the process of bringing together new knowledge. That is the reason why admission to these institutes is very tough. It is unreasonable to expect these institutes to broad base their program. Such an effort will only convert these institutes into NIITs. *These creators are like Gardeners - they cannot work in a hundred acre forms. However, these institutes and the people who work there create course material. Let's call them the 'creators'. Once a certain course is created - it takes perhaps at least one/two years for the course creation - it is available. If we could provide an environment and tool set to these people to create their courses in a way they could be used by other teachers and institutes - we have high quality course content.

The Farmers

There are other kinds of institutes - the teaching institutes like NIITs, many other engineering colleges - whose role is not to create new techniques of teaching and knowledge creation - but to disseminate knowledge to as many students as possible. Unfortunately, in our country - the Gardeners and Farmers are not connected together. There might even be certain mutual antagonism between them. The function of a farmer is to cultivate the land, work with tools and process that enables him to get the best yield from the land, cultivate as much land as possible.

If we provide an environment that can bring together these two communities - we solve the problem of creating high quality educational content. This is not an easy or simple problem to solve. I tried to explain some possible solutions in a use case and examples described in the later sections. The fundamental idea is that we have to create an environment that enhances the role of each member of the community by connecting together the nearest neighbors. In essence, an effective collaborative model removes the need for every member of the community to work with the ultimate end consumer; instead it makes it possible for the members of the community to produce something for the use of their nearest neighbor.

In our model, the Gardeners and Farmers are the nearest neighbors. Once a course is conceptualized by the Gardeners, it has to be created in a way that it is meant for the use of the teaching community of the next level of institutions. If another teacher can use the content - created by the 'Gardeners' - in their own courses, then such content can eventually be delivered on the Internet. The farmers need to enhance the content coming from the Gardeners and transform it such that a large community can benefit from it. In practice, the 'farmers' templatize and simplify the content so that everyone can understand it. It is not surprising that 'the easy how to guides' come from this community. The 'Shauams' series of books is an example make the subject material very easy and simple to understand and practice, but they do not illustrate the deep concepts. These books are used as self study guides. This is the work of the farming community.

The Systems Community

Apart from the Gardners and Farmers, there is a third section of the community. This community makes available the material to a large section of the students. In effect, the third community creates the overall environment, tools and processes and takes the ownership of bringing together the researchers, teachers and students together. This community can further be classified into three categories - content repository owners, distribution experts and finally marketing and sales community.

The tools and processes required by this community are very different from those of the researchers, teachers and students. Describing in detail the environment requirements of this community is beyond the scope of this document, but for the sake of completeness, below is a very brief statement of the kind of tools and processes required by this community.

The Content Repository Owners

The content repository owners are the community of people who create and maintain the overall content. This community has perhaps the most complex of the responsibilities among all the communities of people who participate in this platform. They need to be able to create and maintain the overall virtual university framework and the associated systems, processes and tools to maintain it, update it and take it to the ultimate consumers. Therefore, they need processes, tools and systems for

- maintaining a large scale digital library
- designing and implementing the workflows
- building tools and applications for other communities
- creating and maintaining the underlying semantic network
- maintaining an intelligent configuration management environment
- managing and maintaining the software and systems infrastructure

The Distribution Community

The distribution community requires to identify and reach out to the students, help them to choose the course content, create classroom schedules, provide the student assessment framework, identify and bring together new teachers, researchers and scholars into the platform, enable them to contribute effectively, create an associated feedback mechanism among all the members of the network, and create the interfaces between the various groups so that all of them can work together seamlessly.

The marketing and sales community

The marketing and sales community requires tools and processes for identifying the revenue models, fine-tune pricing models, analyze the geographic and demographic economic patterns of the student community, and tailor the courses, content, pricing based on all these parameters. They also need to be able to find out what types of courses are required and understand the demand and supply logistics.

The model for creating the virtual university

Creating a course material is hard work - especially if it has to reach a large community of people without personal interactions by the course creator. The usual process of creating a course involves conceptualizing the objective and intent of the course, selecting Topics and subject material, choosing the reference material. This is the first step in creating a course. The second step in this process is mainly research work - the creator of the course understand the subject thoroughly, designing a set of lectures, examples, exercises and illustrations. In the first one/two attempts - the course creator mainly and usually completes about 60 - 70% of this work and then he/she completes the rest of the work in the class room - for example - there is lot of on the spot, spontaneous innovation and improvisation of examples, illustrations and exercises.

The third step - the most tedious part of the course creation - is preparing the lecture / course content - this involves preparing notes, slides, class notes, diagrams, topic notes, descriptions of problems and so on. Many course creators eventually strike/design their work flow. They keep reusing certain topics, examples from their library of slides, problems and examples. This process is as time consuming as writing a new book. Many instructors short circuit this process because they have personal contact and interactive sessions with their students. In any case, it takes about three to four iterations for a course Creator to put together the content of the course fully.

If we aim to bring together course Creators/ (Researchers) and the instructors together - we have to provide right tools and an environment for these people that would ease the process of course creation. This environment must provide the following:

- A workflow environment that can be used by the researchers to create a library of topics, slides, notes and examples - and allow them to put together a lecture by assembling the base objects from the library.
- Allow the researcher to select objects from the library and add/modify lecture specific content to the object.
- Allow the researcher to record lectures in audio format, and later split the audio file into separate objects that can be tagged to the slides/class notes.
- Create an environment such that the audio can be converted into text/diagrams/pictures by third party.

- Allow the researchers and teaching community to share their libraries and add content, objects into it and semantically link them together.
- During the class room sessions- capture the interactions, questions, discussions in audio format and later compile them into frequently asked questions or as summary sections to each lecture, object in the lecture.

If such an environment is offered, it will solve many problems

- Because it eases the tedious process of course creation, a researcher would be able to produce a high quality 'multi-media' book at the end of the course.
- Because a large repository of content is made available at a fine granularity and because the objects in the content repository can be connected together by different perspective, the repository acts as a bridge between the researchers and the teaching community.
- Because the environment allows creation, updation of multi-media content, it will remove some of the limitations of delivering a course virtually
- Because the content is not stored linearly, and because the environment allows definition of an 'object' at much lower granularity than a 'complete lecture' - and together with this multi-dimensional semantic indexing - it allows different kinds of users to use and create 'new/bigger' objects and newer/different lectures. This feature essentially allows the environment to grow and develop by itself using collaborative model and community participation.
- The centralized repository can be transformed into a digital library that can be used by various different kinds of users:
 - o Researchers for creating new courses
 - o Teaching community to create teaching material and instruction manuals, to use the library for creating better/ effective virtual teaching techniques.
 - o The student community to subscribe to new courses and also use the library for learning, supplementary and reference materials.
 - o For course coordinators to create new courses and themes.
 - o The universities/ certification bodies to verify the quality of the content and courses and provide certifications.
 - o The marketing, sales, distribution community can use the digital library to distribute the educational content to large sections of student community, identify gaps, new courses and curriculum.

In summary the model proposed above addresses the following important issues:

- It brings together the existing community of researchers, teachers, institutions and create a networked collaborative community.
- It eliminates the need for every member of the community to solve an end-to-end problem of reaching out to large student section.
- It provides an environment and tools to create high quality multi-media course content.
- It eases the effort involved in creating a complete course content by offering work flow and digital library repositories.
- It allows any course creator with no restriction of who they are, or their present occupations - to create, upload content without any need on their part to "worry" about how to reach out to large section of students.

- It eliminates the need for one person to deliver the same course all the time. Once it is handed over to his nearest neighbor - it can be taken forward by some one else.
- Since the community model and collaboration is built into the platform, the content can be created, updated, added used by the community.
- The platform allows various different universities, institutions, and governing bodies to contribute, verify and validate the quality of content, provide assessment and examination and grading systems. It is quite possible for an institute to use the platform to create their own distance education models.

In a nutshell, this model does not make any additional demands on the current capacity, but yet the same time it can enhance the efficiency of the existing community by several orders of magnitude.

At this time, I haven't yet thought of how a virtual environment can offer 'practical' courses that require laboratories, or require students to work with expensive equipment (like electron microscopes for example) or require them to work with their hands (learning machine tools for example). It might be possible to create a model where institutions and universities could offer these services and participate in the network.

Realization and taking it forward:

There has to be an owner of the platform that is described in these sections. In order to realize the platform, we have to address the following problems.

- Need to identify a set of people from different institutions and create the first end-to-end network.
- Identify certain courses and programs for a pilot basis.
- Invest and create the technology, tools, environment and a process that enables us to create the platform incrementally. The technology that is required is very intense and intricate, and cutting edge- it requires us to build workflow tools, multi-media tools, internet user models, management of large scale digital libraries and so on.

Therefore, it has three distinct aspects to it:

- A management aspect - which deals with bringing up different kinds of users, people from different institutions across the country.
- A process aspect - which deals with setting up an organization that can allow people to work without necessarily being part of the organization.
- A technology and engineering aspect - which deals with creating a platform and technology for effective and efficient service engineering and service delivery.