Kaveh Bazargan and CV Radhakrishnan

Kaveh Bazargan and CV Radhakrishnan use TeX extensively in their typesetting business.

[Interview completed 20 September 2006.]

Dave Walden, interviewer: Please tell me a bit about your histories and lives outside the world of TeX and your company River Valley.

Kaveh Bazargan, interviewee: I travelled as a child of 11 with my family from a small town in Iran (Bojnord), near the Afghan border, directly to London. Needless to say it was a culture shock, but as a child I quickly blended in.

I got a Bachelors degree in Physics at Imperial College, London University, and then a Masters degree in Optics, which was a field that fascinated me from childhood. During this course I got interested in the emerging field of display holography. I went on to do a PhD at the same department, entitled "Techniques in Display Holography". For those who are interested, a scan of my thesis is online: `http://www.focalimage.com/public/kaveh-PhD.pdf`.

My main contributions were developments in color holography (using three lasers) and the invention of a compact display system, still marketed in the US as the VoxBox: `http://www.apple.com/science/profiles/voxel/` `http://www.holorad.com/products.htm`

CV Radhakrishnan, interviewee: I live in Trivandrum which is the capital of the southern Indian state of Kerala. Kerala is the first state in the world to have a communist government through elections! We are leftists, but at the same time addicted to democracy. It is the most literate state in India (100 percent literacy), with empowered and educated women folk unlike other parts of India where gender discrimination is still common, lowest infant mortality rate (comparable to that of the first world), fair income distribution among the population, and above all the most green state in India. We recently banned production and sale of Coca-Cola in this state. Now, I hope, you have a fair idea of where I live.

I am a chemistry graduate and dropped out of University during my post-graduate studies. I worked in the shipping ministry of the Indian federal government for several years after my studies.

DW: Mr. Radhakrishnan, please help me and readers who are not familiar with Indian names understand about them. How does naming formality and informality work in (your part of) India and how should I address you?

CVR: In the first place, you should call me Radhakrishnan which is my given name or CVR for short which is much more palatable to the western tongue.

Nomenclature in south Indian states has a bizarre style which might elude the comprehension of people of other countries. In this matter, our brethren in north India are truly international. They have first, middle and surname in their names, e.g., Mohandas Karamchand Gandhi, Indira Priyadarshini Nehru, Rabindranath Tagore, etc. It is

predictable and you will be correct in most situations.

But in southern India, we have names with multiple components where the last part will be the first name or given name and the first one or more parts will be father's name with or without family name. My full name is 'Chandroth Vasudevan Radhakrishnan' where Chandroth is my family name, Vasudevan is my father's name and Radhakrishnan my given name. The first two components are invariably compressed and denoted as initials. Hence, I become C.V. Radhakrishnan which is again shortened as CVR (it is my userid in the Linux world at work and hence forms part of my email too). But with the advent of western education, so-called modern naming practices are followed here too — Rajiv Menon, Nisha Nair, Aneeta Rajendran, Uday Shankar and similar ones can be found abundantly nowadays here in Kerala. My own peasant parents were not 'civilized' enough to adopt unambiguous naming for their offspring, nor am I ashamed of my name though it may represent an old and discarded system.

DW: How did each of you first get involved with TEX?

KB: I have always been obsessed with presentation of information, so I was determined to write my thesis in the best way technologically available. Having started to write the thesis in 1983, before laser printers, PostScript, PCs, etc, I used troff on a mainframe with the output on a phototypesetter. It looked good for all but equations. At that point I discovered that the computer center had a prerelease of something called TEX, which I was told was "mathematically intelligent". This was enough to draw me to it. I found *TEX and MetaFont* in the bookshop and I was hooked from that day on. With great difficulty and persistence I managed to finish my thesis. Of course all the diagrams had to be done using a Fortran program I wrote myself, delivered on microfilm, and printed in the photographic lab. All this meant my thesis was delivered in 1986!

During the time I was writing my thesis I started a company with a colleague with the aim of marketing display holograms, and my invention. It grew fast, too fast, and it went under three years later.

Around 1986 I got interested in the Macintosh, so much so that I spent all my time on desktop publishing. So in 1988 I decided to leave holography and set up a company (Focal Image Ltd, now trading as River Valley Technologies). I started by offering a graphics service to publishers using Illustrator version 1.1. At the same time I let it be known I was also familiar with a system called TEX. The IOP (Institute of Physics of UK) showed an interest, and soon I was typesetting papers for them. After a few years, competition in illustration meant I concentrated on typesetting, and I took on a few people to help me. Since then typesetting books and journals has been my occupation.

In recent years, I have been spending a lot of time trying to revitalise display holography, and I intend to continue to do that, now that my business gives me free time. Setting up `http://www.holographer.org/` has been quite successful.

CVR: I switched to computers and then to TEX as an escape from my motor neuron disease. As I told before, I joined the shipping ministry in Delhi as a junior staff member, whose sole job was to examine shipping contracts and report the defects to the shipping companies and ask them to submit revised ones. During the end of fifth year of my service or so, one day I suffered a kind of buckling in my legs and I went for a checkup in the hospital. The doctors told me that I have a serious neurological disorder namely, perennial muscular dystrophy (the kind of disease which made Stephen Hawking immobile). They said that muscle mass in my body would slowly waste away starting with the lower limbs, I would be bed-ridden eventually and within a period of five years or so I would pass away. The doctors warned that my terminal days would be with an alert

mind and a dumb body, so I should be prepared for this predicament.

Needless to say, this was shocking and agonizing news, but eventually I decided not to give up without a decent fight with my destiny although I knew well that I was waging a losing war. I resigned the job in the ministry and returned home to live the rest of my life with parents. The thought of solitary terminal days began to haunt me. I had a feeling that none of my people will have the patience even to sit beside me and they are quite legitimately right in that matter. So, I began to find ways of keeping the last days busy. Suddenly, it appeared that computers could be one of the best possible solutions; after all, it is a piece of equipment that can communicate. Since it is inanimate, it won't get bored.

But I didn't have any formal education in computers nor any training. It was a time when PCs were slowly making their appearance in the market. I bought an XT machine (present day toys are much more powerful than an XT) and slowly started learning disk operating system (DOS), Wordstar, Lotus123, etc., since I had copious amounts of time. After a year of this self learning where I made substantial progress, I could buy a PC/AT with 2 MB RAM and a 20 MB hard disk which were considered to be luxuriously resourceful in those days.

It was around this time that Prof. Nambooripad of the math department of Kerala University suggested that I learn TEX since it would best fit my scheme of things. TEX itself is a complex language which would take a good amount of time to master, which fortunately I had in abundance. Indeed, it was true and it took around four years for me to write reasonably good macros or packages in TEX or LATEX. TEX proved to be a good pastime on one hand and on the other hand it began to fetch money when I did typesetting work for researchers in the University for submission to various journals around the world. By this time, I was entrusted with the typesetting work of *Entomon* (an entomology journal of the University of Kerala Department of Zoology, indexed in Current Contents) which I still do as a matter of gratitude to its editors. In short, TEX became the sole basis of my existence and saved me from unimaginable levels of mental agony and frustration.

Twenty-five years have passed since I was afflicted with the motor neuron disease. I still survive, although with a weakened physical state (I can barely walk now and soon will be dependent on a wheelchair). I owe considerably to TEX and its originator, Don Knuth, for my current state of well-being. I enjoy each and every moment of my life since it is a bonus to me and I consider myself as one of the most happy persons in the world! — because I have nothing to lose and anything, no matter how small or big, is an achievement for me.

DW: Kaveh, please tell me how you came to get together.

KB: Around 1995 I started hearing for the first time about publishers sending some typesetting work to India. I also started getting contacted by Indian companies telling me I could subcontract work to them and they could do it economically. In 1996 I decided I should pay a visit to India to see what was going on, thinking that things might be about to change. This was probably the best decision I ever made in my entire life!

So while other much larger typesetting companies in the west didn't take the challenge from India seriously, I spent a week in Chennai visiting several suppliers there, some with literally thousands of employees. I didn't find any of them inspiring. After that week I decided to take a week's vacation in Kerala, on the southern tip of India. I had heard about River Valley Technologies there, a group that was setting up TUGIndia. It was run by Radhakrishnan and his brothers, with some 10 employees. I paid a visit to

them. I asked what software they used to typeset pages, and they said TEX was their only tool. This was the reply I wanted!

For a year we subcontracted work to them, and all went smoothly. In 1997 we decided to join forces and merge into one company. My company had been called "Focal Image Ltd" since its inception. They agreed to change the name to this. A couple of years ago we decided that "River Valley Technologies" felt better and described us better. You can ask CVR about the origin of the name if you wish . . .

Things have gone really well in the 10 years we have worked together. There is never a dispute, and we see eye to eye on almost all issues.

DW: Radhakrishnan, what is the origin of the name "River Valley Technologies"?

CVR: I was born in a village 40 km south of Trivandrum. Fifty years ago, it would have been like a habitable forest; the main occupation of the people was farming. This agriculturally based society lived at a very slow pace and depended on nature for everything. Rice, bananas and vegetables were the main farm products. Kerala has such a large number of rivers and backwaters, no matter where you live, you need to cross a river before you reach your destination. Often, it adds scenic beauty to your habitat, but it is not without its own miseries. During monsoons, floods are quite common, devastating huge farm lands and crops. Floods also caused displacement of human settlement at least once in a decade. During my school days, we needed to cross at least one river whichever way you chose to reach the school. We, all the children in the neighbourhood, always walked to the school which was roughly three kilometres away. During monsoons, as you can imagine, the rivers will be flooded. We used to remove our trousers and shirts, bundle them along with our textbooks and swim across the river by holding the bundle high above the water level. Upon reaching the other shore, we wore the clothes and ran to the school. The affluent amongst us, particularly girls, had the privilege of their parents accompanying them with country boats and rowing them across the flooded river. These girls while sitting in the comfort of their boats and security of their elderly people used to howl at us for swimming nude, but we were hardly bothered.

Anyway, rivers had a big impact on our lives, whether it be floods, rice production, human displacement, scenic beauty of our surroundings, drinking water, rowing and boat races, etc. They are an inseparable element in our lives and hence I chose a romantic name which imbibes the spirit. Also, I hated to think of having any name with words like info, infotech, sys, etc., which most of the software or related companies have.

DW: Radhakrishnan, had your work with TEX already expanded and turned into a business before you met Kaveh?

CVR: Yes and no is the answer. I had a large quantum of text processing work from the University which I couldn't do single handed. On the other hand, I was not organised enough to run a full fledged company on a commercial scale. So, when the pressure of work and demand for services escalated, I decided to open up a company along with my two younger brothers (Rajendran and Rajagopal). Thus River Valley Technologies came into existence in the premises of the Software Technology Park (STP) in Trivandrum. We here in India have several STPs sprinkled all over the country as a support mechanism to help incubate entrepreneurs like me who want to do business in software or IT-enabled services. STPs provide one-stop shopping for all government clearances, infrastructure like communication, uninterrupted electric power, floor space, broadband connectivity, etc., at a subsidised cost so that newcomers like me who are not resourceful enough can suddenly afford and make use of the above services. Apart from this, any registered company in the STP need not pay taxes or duties of any kind (like customs) for the first

eight years of its registration. This way, start-up problems of a new company can be minimised so that more and more people will be attracted towards the software business. On a reciprocal basis, companies have to export software or allied services to other countries which is obligatory on each and every company registered in the STP system.

River Valley had an export target of one million dollars to be achieved during the first five years of its operation (STP would decide our fate for the next four years once this was achieved). Since I didn't have any contacts anywhere outside India, doing an export business was a very distant dream for me. At the same time, I needed to do it, otherwise I would face stiff penalties from the government. Naturally, I forgot all the strains and hardships which my physical body was facing due to the disorders; that was one of the advantages of this business endeavour.

I was also passionately working on a not-so-unrelated area called free software (not open source software — they have subtle political differences), the Linux operating system and its propagation, and also organising TEX users in the country. During this period, I came in contact with Sebastian Rahtz who was working for Elsevier at that time. He was also a member of the UK TUG Board. Indeed, he prompted me to organise a TEX user group in India so that he could come and help inaugurate it if we were to have any kind of a formal ceremony. So we formed a user group at a meeting of like-minded TEXies held on 16 December 1996 (this day is very important in my business life). Prof. Nambooripad was the first president, and I happened to be the first secretary. The evening of the same day, I sent mail to all the TEX user groups around the world announcing the formation of the Indian TEX Users Group (aka TUGIndia), its mailing address and a who's who of TUGIndia.

The mail went to all user groups around the world. It reached UK-TUG when its board meeting was taking place, where Kaveh was also present as a board member at that time, along with Sebastian and Dominik Wujastyk. Kaveh was intending to visit India within a week or so, so he told the board that he would meet the guys when he visited India. The UK-TUG Board decided to send Sebastian to India to inaugurate TUGIndia formally and paid the flight charges from its funds.

Sebastian and Kaveh were present in the inaugural ceremony. It was a huge success; nearly eighty people from different parts of India attended and signed in on the first day.

In the meantime, Kaveh and I had enough discussions about our business plans as Kaveh already mentioned. Returning to the day of the formation of TUGIndia, it reminds me of what Paulo Coelho wrote in *The Alchemist* — that Nature often conspires to help us achieve our goals, keeping dropping omens and hints for us to latch on to. Although we would be, particularly our rational mind would be, more than happy to reject such Vedic thoughts, often I am tempted to see an element of truth in it. There we were! Kaveh actively searching for a business partner in India and I looking for someone in the West. So we joined hands without any hesitation.

DW: Kaveh or Radhakrishnan, how do you divide up the business activities between Kaveh's branch of your company in London and Radhakrishnan's branch in India, and has your partnership allowed you to obtain different kinds of business or just to expand your original businesses? Also, my understanding is that mostly only electronic files go between your two branches, and River Valley doesn't get involved in actual printing and the physical aspects of publishing; is this correct?

KB: I feel I have the best deal, as Radhakrishnan takes care of all operations in India, including production and all the R&D. I see myself as the client interface and also a strategist. Thankfully I still have enough knowledge of each part of our technology and

I often come up with new ideas of combining the technologies (i.e. software), making things more efficient, going into new areas, etc. An example might be our current foray into multimedia. I feel that publishing should be in any medium, and not purely text.

The plentiful supply of talent in India means that it is possible to follow up some of the wild ideas that I have, so it has given me more freedom than I had before.

It is correct that there are virtually no physical items passing between us and all is electronic. The final product of our company is PDF files and other electronic deliverables. The publisher then arranges printing.

DW: Radhakrishnan, at the recent PracTEX'06 conference in New Jersey, Kaveh's presentation on River Valley's approach to managing vertical stretch in TEX was the most relevant presentation to my needs as I had just finished typesetting a book in LATEX and the major issue was balancing the text bodies on a two page spread. Kaven indicated that you did the coding of this technique. Please tell me a bit about the business problem you were solving and hint at the method of the solution (no need to repeat what will be in Kaveh's paper from the conference).

CVR: Nature Publishing Group (NPG) is our newest client. We typeset a few of their journals which are predominantly mathematical. Also they wanted to accept author submissions for their journals in TEX format, which would attract authors who prefer to use TEX as their document preparation medium, authors who would have otherwise been turned away owing to the requirement of submissions in a word processor format. I feel this was more of a decision based on business directions on the part of NPG rather than the typographical elegance that TEX can bring to their journals or any love for TEX. The design of NPG journals is not conducive to the typesetting process of the TEX engine. It is more of a glossy magazine type with several fancy fonts in a multitude of shapes and weights than that of the simple but elegant publications that we usually find in academia.

As you can imagine, we faced several technical problems of typesetting their journals in LATEX. Many people are not aware of the limitations of using multiple fonts for math in TEX. You run the risk of a 'too many math fonts' error very soon. There were no math symbol fonts available in either the free or proprietary worlds that could go with Minion (light, medium, demibold, bold) or Helvetica Neue (light, medium, condensed, bold condensed, bold, extrabold), the text fonts used as serif and sans-serif families respectively, So, we had to generate several virtual math fonts that drew symbols and extension characters from mathtime, STIX fonts and a variety of free fonts in CTAN and math characters from Minion italic (light, regular and bold) and Helvetica Neue italic (light, regular, condensed, bold, extrabold). This process ended in defining several math versions like normal, bold, sans, sans condensed, bold sans condensed, etc. Every time we typeset a document, we are at the verge of reaching the font limits of TEX!

The woes didn't stop there. All NPG journals are in two column format. And in the normal traditions of two column typography NPG wanted grid snapping which evoked a terrible problem in LATEX. ConTEXt has a grid snapping facility, but LATEX sadly lacked this feature. LATEX always uses several glues which are often uncontrollable too. Unfortunately math characters with varying heights need this feature to adjust various boxes to get a reasonably acceptable page. Luckily, however, the design of NPG journals helped us in solving this problem. Their scriptsize and scriptscriptsize were so small that math notations with two levels of sub/superscripts won't touch the adjacent lines, meaning we did not need to worry about surprises in interline skips between columns in a page. If we used the standard math sizes (for 10 pt basefont, scriptsize is 8 pt and scriptscriptsize is 7 pt while that of NPG happened to be 6 pt and 5 pt respectively), our grid snapping

mechanism would obviously fail.

So, the next culprit that can upset the grid snapping is the floats and float separators. We simply rounded off the float height to the nearest baseline and the grid snapping problem was solved. We did a similar thing with various heading levels too.

This way, we began to deliver PDFs to NPG that conform to their precise specifications. Had it not been done, it would have always been a black mark on us and our competitor companies can snatch away the journals from us for this reason.

DW: Please tell me a little about how your typesetting process works?

CVR: Authors generally provide TeX sources, but authors of some journals prefer to submit MS Word sources. Our journal publisher clients generally upload author sources in their ftp site and send notifications to us. We grab the archives and book the items into our tracking system. Elsevier has a more advanced system; they copy author sources to an electronic warehouse along with a purchase order in XML format. Our tracking system communicates with this warehouse at fixed intervals, grabs the documents and automatically books the jobs into our tracking system based on the XML order. Then someone will print the author PDFs and add the document sources to a CVS server. Once the job is booked into our tracking system, it will be listed in the TODO list of all our staffers who have privileges to do it. Sorting of items is done on the basis of return date.

Structuring and enrichment of author sources is done in a semi-automated way, then structured LaTeX → XML → LaTeX → PDF conversions are done completely automatically, the result is proof-read, bugs are fixed, a dataset is made, and the tracking system will upload to electronic warehouse automatically with an XML ready signal message.

Our workflow is completely automated, except the first stage of structuring and enrichment of author sources which is done semi-automatically.

DW: What sort of workers do the actual typesetting?

CVR: If you mean their qualifications, they are all science graduates.

DW: What set of TeX components, formats, and classes do you use in your business, and whose distribution?

CVR: ε-TeX and pdfε-TeX, LaTeX, and custom classes.

DW: What TeX distribution do you use?

CVR: TeX Live, and we keep our configuration in the local TeX tree.

DW: What editor or editors do you use within your business?

CVR: Vim and FTE (Folding Text Editor), although I personally use Emacs.

DW: Are you able to stay in the world of TeX and free/open source software or do you also use commercial products as well?

CVR: We do use Photoshop and Illustrator to process figures, because there are no free equivalents available that can create production quality graphics. All the rest of operations are in free/open source software, including our stable operating system, Linux. Ours is a Microsoft-free zone.

DW: I am fascinated by the statement at your web site (`http://www.river-valley.com`) under the heading 'Culture of Innovation' that "We always work at around 60 percent capacity, using the remaining time to explore new avenues. The whole team is encouraged to innovate, and the sharing of resources is pivotal to our success, not only between staff, but also with our clients." Please tell me about how you came to have

these goals and how they work out in practice; in particularly, how are you able to resist the temptation so many businesses have to schedule everyone at 100 percent of capacity and work them at over 100 percent when unexpected things come up?

KB: Our staff are our greatest asset, and we think that looking after them is more important than looking after our clients. Quite literally. If we work them into the ground, they'll leave eventually and all will suffer, including the client. In fact we have literally thought of having as our motto: "River Valley: Where the Customer Comes Second!".

Neither Radhakrishnan nor myself are money oriented. Making money is one of the goals of the company, but only after doing the right thing, and in the right way.

On the practical side, I believe that our extremely high level of automation, and our reliance almost exclusively on free software, has allowed us to minimize costs, therefore there is less pressure on us to bring money in. And we really enjoy the relaxed atmosphere in the office. In the long term we are convinced this is the way to do business. So far it has worked very well.

DW: Was the 60 percent number chosen on theoretical grounds — because that is where the knee of queuing curves frequently begin to turn toward infinity?

KB: Radhakrishnan can give a better answer to your question than myself. For my part, I just go forward intuitively, making sure no one is actually wasting time. So if 60 percent of their time is taken up by production, then 40 percent should be spent on trying out ideas, general R&D, etc. If people just sat around doing nothing I would be worried.

CVR: I think what you're saying is from a management expert's perspective. I am not a management expert nor have I studied management at any level during my studies. Everything I did and do now originates from experiences of day to day life. Before getting into the current business, I too happened to work in organizations that were busy, schedule driven and where several management experts interacted for extracting maximum output from the staff members. Needless to say, most of them failed to deliver the desired results, the main factor, I think, being the negligence of human factor in their planning. So I contemplated on many occasions that I would have an entirely different approach to people if I happened to head a business in the future. I will summarise my wishful thinking in the following manner:

- Clear vision of how the organization should be a decade, say, in the future and what its short and long term objectives should be. None of the staffers, no matter how low or high their position in the hierarchy, should be marginalized in the matter of awareness of these factors.
- I should be meticulously honest and transparent so that I can request/expect these virtues from others in the organization too.
- Avoidance of unending meetings of executive members which starts early in the morning, go on and on, and when one ends another starts with people having to rush to the next meeting.
- Avoidance of imposition of schedules on staffers which I clearly know are humanly impossible to achieve. Managers usually impose impractical schedules to extract more work from employees.
- Lastly, due consideration of the 'Indian factor' which is special to India alone.

In India, unlike other parts of the world, an individual doesn't live for himself; instead he lives for his family. Whether it is good or not, his individual life is mostly dominated by the interests of his family, (s)he will sacrifice anything for the sake of the well being of the family. The interests of the family is the most dominant factor in one's life. So,

when you have seventy staff members in your organization, you are not interacting with seventy individuals; instead you are talking to seventy families which makes things much more complex than expected. Motivating such an work force is very difficult unless you take into consideration the hardships brought about by the family factor on each individual's life.

I have deeply analyzed this problem at length, because I was irreverent about this family factor in my life. I was a radical from the very beginning, challenging every rule imposed on me by my family establishment and eventually liberating myself from its irrational clutches, for which I had to pay a big price in terms of emotional tranquility. The five thousand year old history of Indian civilization is nothing but a history of obedience. In the beginning, at the macro level, it was the subjugation by cruel monarchs for several millennia, then that of the colonial masters for a few centuries till the middle of the last century. At the micro level, the ruling of masters of the families who might be grandparents or parents or teachers, or elders or husbands, etc., controlled the individual lives. The concept of freedom and free will were brought about by the colonial masters through English education (indeed that is the greatest contribution of our British colonialists), but the execution of freedom and free will was reserved for British masters, while natives were deprived of these. Our democracy is only sixty years old which is unlikely to be a sufficient time span for making the individual psyche mature enough to perceive the world as our counterparts in other civilizations do.

As such, when you have seventy staffers with you, on the one hand they wait for your orders since they are trained to obey only but. on the other hand, they are at the mercy of the dictates of their family establishment which may at times conflict with that of their work establishment. An average Indian is always in the middle of this internal conflict of interests, and at least one third of his mental resources would commonly be preoccupied with the polemics brought out by the family. Productivity of an average Indian is very low when compared to his counterparts in other Asian countries.

Since one cannot find enough brave individuals who feel unconstrained by the challenges of family establishment, one is left with the scenario of finding the best people one can from the population to organize a workforce and allowing them to be as effective as they can be. So, I decided to use only 60 percent of the capacity of each individual with a tolerant attitude so that he would be motivated to bring out the best out of him — which is always over 60 percent in my experience.

Our company is very small and I can manage my workforce very easily without any rumblings or hatred since I know each and every individual at a personal level too. I still do not know how this factor can be effectively handled if the workforce numbers in the thousands.

DW: I know Kaveh is involved in TEX user group activities; I recently met him in person at PracTEX'06, and he is on the editorial board of *The PracTEX Journal*. And Kaveh mentioned Radhakrishnan's company was involved in setting up an Indian TUG when the two of you met. Please give me your views of the value of TEX user groups (areas where they can help and areas where they can't help much), and tell me a little bit more about your personal involvement in them.

KB: I used to be active in the UK TEX users' group, until it effectively disbanded some years ago (although there has been a recent and welcome revival). The major advantage of TUG for me is the TUG conferences which I try to go to.

CVR: I was involved with the formation of TUGIndia as we described before. Usage of TEX in India is mainly confined to various text processing companies and as such not

much development effort is directed towards adding new features or writing more useful packages. If there is any development at all, it is confined within the business houses and in essence they are unknown to the world at large. Although India has a huge establishment of higher education, usage of TEX, unlike in other parts of the world, has traditionally been confined to a very few academic institutions of higher learning such as the Indian Institute of Technology, spread across ten different centers, and Indian Institute of Science, India's premier scientific research institution. So TUGIndia decided to propagate TEX among academia. With novice users in mind, we wrote a tutorial spanning seventeen chapters, generated attractive screen and print versions which were disseminated through our web site `http://www.tug.org.in/tutorials.html`, along with sources and supporting packages so that people can play with them if they want to compile the documents by themselves. We released a notification to the academia about this venture. The effect was dramatic, there was a quick surge of registration of subscribers for the mailing list and the membership soared to more than 600 immediately. Suddenly the TUGIndia mailing list became very active and attracted subscribers from other countries as well.

We arrived at a logical conclusion that key factors for promotion of TEX are good documentation and quick technical support for the needy. We then started writing another tutorial for TEX graphics, the first part of which is still going on with ten chapters completed and released so far. The total download of graphics tutorial is a whopping number of 162,408, and that of our LATEX primer is 26,579 as of September 19, 2006, from `sarovar.org`, the free software portal where tutorial projects are hosted.

TUGIndia is not positioned as a forum to support the business houses; instead it is aimed at helping any TEX user when his problem surpasses the limits of his expertise. However, I find a great potential role for the TEX user groups to act as a prime technical support base for the text processing industry. Since TEX is free software, no commercial outfit is available for technical support when companies in the industry look for paid support. I would love to assume a kind of role for the TEX user groups which is akin to what Red Hat provides to the promotion and support of Linux — a mutually complementary and beneficial relationship. This would dispel the anxieties of the text processing industry when they decide to deploy TEX systems for their daily operations. During private talks with executives of several other companies, I got the impression that they would love to deploy TEX systems having seen our silent and peaceful operation, but they were scared of the scant technical support on commercial terms.

It is worth mentioning a recent development in the text processing world. As you may be aware, most of the text processing companies use 3B2 for academic journal typesetting. Arbortext recently acquired Advent (which owned 3B2); people were a bit scared, but Arbortext came for their rescue saying that they would support and continue 3B2. But within six months, Arbortext was acquired by another CAD/CAM company (I forget the name). The new owners were silent about the continuance of 3B2 system. People are really scared now, and the belief that proprietary systems are more reliable than free/open work has vaporised. Some companies have already started development centers for TEX in India which is good news for TEXies. I have had a few requests for consulting too, but declined owing to my own neck-to-neck routines.

At this point, one could logically conclude that a Red Hat–like company for TEX would be relevant. But realities are different. TEX programmers, like any other free software gurus, are an eccentric lot. They still have a method in their madness, but it is more fit for fixing an algorithmic imbroglio in software than salvaging an enterprise which is drowning in upset schedules. Red Hat is a great success: they could somehow go

beyond the threshold which delineates the insane and sane judgements. But similar experiments elsewhere failed miserably. You might have heard about FreeDevelopers.net (FD) with headquarters in Washington, a global company of free software developers (of which I had a reasonable role among TEXies — Ross Moore was at the top of the ladder) which tried to evolve a free software business model. Richard Stallman was also part of FD. Looking back, the achievement of FD was nothing but megabytes of mail archives which discussed at length about business, software freedom and ethical values. So we concluded that free software has no business model and FD disintegrated.

However, I find something relevant to this discussion is taking place in the TEX world — the release of TEX Live every year (almost) without fail and the maintenance of the CTAN repository. Often I have admired at the veracity of all developers involved in TEX Live releases. It is here that I would ponder about the possibility of offering TEX Live systems just like Red Hat offers Linux in two versions — one for enterprises on a payment basis for support and another for the community for free. If TUG comes out to organize a set of willing developers into a support group on a payment basis, they can sell this service to the industry for a price, it would be beneficial to both the parties.

DW: How do you see TEX and your use of TEX evolving going forward?

CVR: This is a big issue and what I am talking about is the usage and longevity of the TEX system in the text processing industry. Several factors go against the TEX system:

- conflicts among paradigms of modern and traditional typography
- problems brought out by the proliferation of electronic media
- the apparent user friendliness of WYSIWYG typesetting systems
- structural unification of document sources into XML and apparent disabilities of the TEX system in processing XML as dictated by the XSL-FO specifications of W3C
- conflicts of interests within the TEX community that hamper promotion and usage of TEX as a preferred typesetting engine
- the fear/psychosis of successors of Knuth in the matter of redesign of the TEX compiler

Advent of digitized typesetting has its own ill effects on typography. I have a Calculus book published by Cambridge University Press in 1963 typeset in the traditional way, manually composing the pages using metal typefaces. It is far superior in typographical elegance to any mathematics book which I have seen typeset digitally. Knuth has made a remarkable effort to bring about this quality in digitized typesetting when he developed TEX and he realized a good degree of success. However, publishers are not interested in perpetuating the typographical traditions and finesse attained over decades or centuries of typographical innovations. Often publishers are driven by convenience and cost reduction and typographical excellence becomes a last priority item.

When math structuring was unified by W3C with the emergence of MathML, the typographic finesse attained by TEX gave way to structuring priorities. For instance, we have several kinds of multiline constructs like matrices, arrays, cases, aligned equations, centered multilined equations, etc. MathML considers all these as math tables. But in TEX these are different constructs (although the base building block is a math array) with ultimate control over both horizontal and vertical spacing between math elements. Hence, even if you use TEX engine to process MathML-coded XML, all these constructs have the same kind of spacing. Since it preserves the semantics, publishers are more in favour of it than doing things in TEX's native way. So, systems like 3B2, which does exactly what publishers want, are promoted by the text processing companies which erodes

typography further.

When we started our business, the deliverables required by the clients were confined to printable output (mostly a PostScript or PDF file). But with the advent of the web as the medium of dissemination, the number of deliverables has increased, including a print version PDF, screen version PDF with low resolution figures and hyperlinks, gif images of all math inline and displayed formulae for delivery of a document in HTML format on the web, full length XML of the document, header XML, and bibliography XML. TEX systems became sidelined owing to technical difficulties although TEX can very well generate all the above as we do in our company.

The main problem described against the TEX system to generate these various deliverables is its batchmode processing properties. Since, people are wary of command-line mode and they love WYSIWYG typesetting systems which are available in various incarnations like InDesign, 3B2, etc., TEX systems gave way to them. But the fact is that TEX systems are much faster, highly programmable and provide the desired output flawlessly within no time so that a high level of automation is possible. To give a specific instance: generation of 3,000 serially numbered gif images of inline and displayed math formulae in an article conforming to the specification of a client would take hardly 40 seconds using TEX, while using the procedures in many of our competitor companies entails hours of work. One of the suppliers of Elsevier Science who recently visited our company to see our workflow told me about their long backlogs of gif generation. However, they feel taking this trouble is a lesser evil when compared to taming the horrendous macro language of TEX.

XML is now the definitive document source format which is a great achievement of mankind. Not only humans but also machines can communicate each other by interchanging XML data and initiate processes, the best example being our tracking system and the electronic warehouse of Elsevier Science. Since it has become the definitive source, efforts are needed to translate each and every author submission into XML format and derive the final deliverables from the XML source for safeguarding the accuracy and fidelity of source and output. W3C has come up with a specification on a style sheet language called XSL and a formatting objects specification, XSL-FO, which are very useful in determining how to process the XML data. There are many formatting object processors (FOP) around, in both the commercial and free worlds. RenderX is a leading processing engine in commercial world while Apache FOP is a leader in the free world. But none of the processors so far are as intelligent as TEX in math awareness and the best option would be to process XML documents with math content with the TEX engine. Unfortunately, TEX doesn't have the capability to process XML documents directly, forcing one to translate the XML back to TEX again with an XSL style sheet and then generate PDF as we do in our company. I do not forget the features available in ConTEXt, but I am sure, it will raise myriad issues to generate the desired output from XML.

However, there has been intense work going on in the Apache FOP project to integrate math processing capabilities into their engine. Once, this is accomplished, I feel the relevance of TEX as a preferred tyepsetting system will find greater challenges than it has ever faced and its usage will dramatically decline. Some of the inherent weaknesses of TEX like processing multiple columns, wrapping text around floats, grid locking of lines across columns, placing floats across two spreads, etc., are part of the XSL-FO specs and accomplished by some of the existing FO processors, and push against the propagation of TEX in an XML-dominated world.

To make matters still worse, there are several schools of TEX usage in the world like plain, LATEX, ConTEXt, AMSTEX, Eplain, etc. All these macro systems provide several fea-

tures which the others do not have. However, when one tries to do a job, all the features needed to process that job may not be available in a single system. For instance, I was trying to shift our typesetting part from LaTeX to ConTeXt owing to its better column handling, graphics, MetaPost integration, etc., but postponed that effort since it sadly lacked features like line numbering in column mode, advanced math processing, bibliography citation handling, etc., which are still not production ready. Such problems would incline a production house to go away from TeX unless one has an infatuation with it. Personally, I have been advocating for integration of differing macro package systems into a common kernel with a facility for modular loading as and when the user needs it. This happened once in the TeX world when AMSTeX and LaTeX married each other which provided all the advanced math features of AMSTeX and sectional units, tabular, lists, bib citation, cross-referencing, floats, etc., of LaTeX in a single kernel. The user has the freedom to load the required modules. Similarly, if LaTeX is conceived as a module of ConTeXt or vice-versa, it would have been a great achievement towards unification of divergently capable systems in a single one. But I do not think, LaTeX and ConTeXt purists would agree to this; people would still re-invent wheels and users would continue to learn different commands to create similar looking output using different macro packages.

And finally, there is an apparent fear among the successors of Knuth in redesigning TeX to suit the present day XML world. I am not fully qualified to understand the innards of TeX the program, but when I talked to subsequent compiler designers who did much work on pdfTeX, NTS, etc., they all shared the same view that TeX is a composite program which resists all forms of redesigning while keeping the backward compatibility with addition of new features. Either you rewrite a newer one or keep the current one as such. Rewriting a newer one is a daunting task which should accomplish what TeX has already done plus the extra features needed. The brave efforts to create LuaTeX which is an integration of pdfε-TeX, Lua, MetaPost and Aleph into one engine, may be a worthy answer and raises hope for the future.

Having said the above, TeX is not without its positive points for survival. It is a superb authoring tool that can defeat all other systems, the main advantage being the separation of format from content which provides enough momentum to one's train of thought to avoid falling victim to formatting nuances while authoring. And since it is free software and academia is not endowed with equivalent proprietary text formatting systems, authors will prefer to use TeX. Certain math constructs like proof trees composed of deductive logic steps can be typeset only in TeX; I can't imagine any other easier methods than what is provided by TeX in this matter. Shading of proteins in a DNA molecule as done by the `texshade` package is yet another example of how horrendous tasks can be easily done in TeX which saves a lot of headaches for researchers in protein chemistry. Multiple accented characters, composite glyphs, footnotes inside footnotes, different kinds of footnotes in same page are some items useful to researchers other than those in scientific disciplines. Therefore, it is hard to find such a suitable authoring tool for several years to come unless someone comes up with an alternate system.

TeX is one of the best tools for database publishing. The phone directory comprising 400,000 subscribers of Trivandrum Telephones was made using TeX. That story can be found at `http://www.tug.org.in/bsnl.html`.

A print-on-demand system can be designed based on this capability of database publishing. Suppose a tour operator wants to provide information based on the custom requirement of a customer; he can surely make use of TeX. He can keep information about several tourist destinations of different kinds with different price lines in XML format with a properly designed XML DTD. He would provide a web page where people can

login and submit several scope conditions such as, I want information about destinations which fall under such and such price line, with a homestay-like accommodation, away in the hills, tropical countries, etc. An XSL style sheet will search the XML data and create a TeX input file based on the conditions provided by the user. pdfTeX can be called in the background, and a beautifully typeset PDF with all gizmos can be sent to the user and he will be very happy. I have heard about several print-on-demand servers functioning around the world providing formatted educational material as per the custom requests of users. One system in Germany provides bus/tram timings and fare rates between two destinations; the underlying engine is TeX.

Several corporations use TeX in different forms. Trivandrum Telephones makes use of pdfTeX to dynamically generate and provide telephone bills when the user submits an online request. The PDF is tamper proof, has a dynamically generated barcode and is exactly like the regular printed bill. This has been working for several years now successfully. I know one telephone company in US employs pdfTeX to create telephone bills of their clients because it is the most viable system for them since each client bill is around twenty thousand pages! No other system can generate the bills so fast in batchmode from a database.

The most exciting work which we did during the past was the report generation of a World Bank study of school dropouts in Kerala. The database comprised 1.6 million records each with 174 fields. Complex statistics were applied to this data and a report generated in the form of a TeX input file which when typeset yielded 748 tables of 64 columns and 32 rows each. All pages were complete in all respects: page numbers, headers, footers, heading/subheadings and captions for tables. This saved us from the horrendous task re-keying the statistical results in a word processor or whatever, printing and proof-reading the output. Needless to say, the World Bank was immensely happy.

So I believe that although several factors apparently seem to go against the interests of TeX in general, it is still usable in many areas of human activity and as such the disappearance of TeX is very remote, at least in my lifetime.

DW: Thank you, gentlemen, for a fascinating interview. Your story makes me want to find a partner in India and start a business, except I suspect the synergy of your relationship may be impossible to reproduce.