

[Editor's note: The following is an edited transcript of the panel of Internet pioneers at the Potsdam celebration.]

## Panel Discussion: The Road to the First Email\*

*Date: September 19, 2007*

*Location: Hasso Plattner Institute, Potsdam Germany*

*Moderator: Dennis Jennings, first director of the U.S.*

*National Science Foundation Net (NSFNET)*

*Panel:*

*Jay Hauben, Internet historian, Amateur Computerist Newsletter Editor*

*Prof. Hu Qiheng, Chairwoman Internet Society of China (ISC), Honorary Member of China Association for Science and Technology, member of Chinese Academy of Engineering and the Chair of Steering Committee for CNNIC*

*Daniel Karrenberg, Chairman Board of Trustees of the Internet Society (ISOC)*

*Prof. Lawrence H. Landweber, Co-Founder of the Computer Science Net (CSNET)*

*Dr. Stephen S. Wolff, second director of the National Science Foundation Net (NSFNET)*

*Prof. Werner Zorn, Hasso Plattner Institute*

**Zorn:** Hello. I welcome you and welcome the panel. I want to introduce a little the persons on the panel.

I start with Dennis Jennings. He is sitting in the middle. Because of his smart Irish/English accent, I chose him to chair the panel. He was so friendly he could not resist and say he would not do the job. But he is also a very important person in networking. Dennis was the director of EARN, the IBM driven or based European Academic Research Network in the 1980s. So Europe was for a while his job. Underneath him were the directors in the different countries. Then his most prominent job was the project leader of the NSFNET project in 1986-1987, the supercomputer network in the United States. He came from Dublin and spent a year there.

**Jennings:** Fifteen months

**Zorn:** Fifteen months. You see, he is one of the cornerstones in networking.

Larry Landweber is for me the father of scientific networking. He ran the International Academic Networkshops. He was one of the founders, perhaps the originator of the CSNET idea in the early 1980s, propagating the idea of connecting all the different networks first through email and then migrating to other services. Larry organized these academic networkshops every year in different places. So he gave me the chance to also travel around the world. It was very nice and also very productive. Larry was later president of the Internet Society for two years in the early '90s after Vint Cerf. Larry became our good friend. So and helped us, backed me, behind the stage.

Stephen Wolff was director of the networking network project within the National Science Foundation for ten years, a long time during the important years in the '80s and also in the '90s. Steve gave that important signature<sup>1</sup> to us. He represented the policy from the NSF side toward networking. We will ask him later why his signature was so important. What would we have done without it? It was one of my questions. And he is now with Cisco for five years.

Daniel Karrenberg is originally coming from Dortmund<sup>2</sup>. Dortmund was a second source besides Karlsruhe<sup>3</sup>. We were two friendly connected institutes. Dortmund was origin coming from

the Unix network side and Karlsruhe by CSNET. Daniel emigrated quite early to the Netherlands. We may ask why you emigrated and went to the Center for Mathematics and Informatics (CWI) in the Netherlands, the Institute which later ran the RIPE registry which became one of the most important registries in the world. RIPE covers 30 percent of all IP addresses, very important, which cover a big part of the northern hemisphere.

Stephen and Daniel have been honored with the John Postal Award, Stephen in 2002 and Daniel in 2001. Is that correct?

**Karrenberg:** 2001, I believe. I am not sure.

**Zorn:** I think you were honored because of everything, both running services and also for your contribution in the IETF with the RFCs to prolong the life time of IPv4 address space through Classless Inter-Domain Routing (CIDR). That was one very big contribution. The Internet is alive more than ten years later because CIDR solved a problem threatening the Internet. You can perhaps say a few words to that.

And Stephen Wolff of course for his important role with a big governmental project.

Madame Qiheng Hu has introduced herself through her speeches while the others were only sitting and listening. She is the president of what I guess very soon will be the largest Internet Society of the world.

**Hu:** The Internet Society of China which began in 2001

**Zorn:** China has more than 160 million Internet participants.

I think Mdm. Hu entered networking in 1994. Was that the year when you entered into network management?

**Hu:** Not really management, merely I was among the people who did urge the Internet to enter China.

Then in 1994, with your help, Prof. Zorn, we moved the .cn domain name server from Karlsruhe University to China where it started to work on May, 1. In 1997 the CNNIC was approved by the Chinese governmental authority. The number of Chinese people online started to grow fast. In May 2001 we established the Internet Society of China, and, to our great honor, we successfully hosted the 2002 ISOC Conference in Shanghai. Today, the number of Internet users in China approaches 200 million.

**Zorn:** Last, before I sit here modestly, I want to introduce Jay.

Jay Hauben helped me to bring our story into recognition and he plays a role of a historian here on the panel. He is at the Columbia University and edits the Amateur Computerist newsletter or magazine. And Ronda Hauben will give a speech on Netizens this afternoon. She coauthored a book about netizens.

Jay is the most, most accurate writer and researcher I ever met. For, whatever I said, he answered, "Prove it." So I had to set up all the contacts through my old Chinese friends and get material out of my archives. And he pushed and pushed and pushed me. And finally he believed what I said. But I had to prove everything. And now on the panel his role will be to raise a finger and say all what you do should be written down otherwise it will be forgotten. That is also maybe one of the

topics of our discussion, to keep that in mind, and on paper not only on CDs.

Ok. So far my introduction so you will know why these people are all my companions in different stages of what I did. I am really happy that you all came here. Without any one of you, we would not have completed that route. So I really feel happy now to have everybody here that you saw in my slides. Everyone is here exact perhaps Dave Farber but he was a little bit further from me. Now I want to express my thanks again that you have come so we can have a small but very high level Internet summit. Would you agree?

One more question. Most of us met last at the Internet Society yearly conference in Washington in 2002. I think that was the last INET conference. Why wasn't the tradition continued?

**Landweber:** I think that their time had passed.

**Zorn:** That's an interesting point.

Ok. Now I stop with the introductions and sit here. And Dennis it is your turn now.

**Jennings:** Werner, thank you very much indeed. And thank you for managing all those introductions which saved me a tremendous amount of work as the moderator of this panel.

First of all, my apologies. I speak neither German nor Chinese. So I will speak in English and I'll do my best to be understood.

It occurs to me, as I look around and as I talk to people young and indeed old that now use the Internet, that most people just simply assume the Internet is there. It works. All the things that we use, that they use day to day has always been there as far as they are concerned. And they have no conception of the background or the history or the struggles that went into creating this thing called the Internet. That's the first question I would like to put to each member of the panel. What now seems so simple and so obvious, Larry, was it always like this or were there, was it different? What are the war stories behind the story?

**Landweber:** If we go back to the 1980s, early 1980s, there was a research project that DARPA<sup>4</sup> had supported that developed TCP/IP. But there was no Internet. In the early 1980s, the U.S. Defense Department and the National Science Foundation were interested in exploring building the Internet. On the other hand, there was an international standards effort called OSI for Open Systems Interconnection and officially every government in the world except perhaps Finland supported the OSI effort. Hundreds of millions, perhaps billions of dollars were spent on the development of a protocol suite that would become international standards. And most countries of the world, the national science foundations would not put money into internet development including in Germany and also the United States except for the Defense Department, NSF and maybe the Department of Energy. There was very little support for the Internet. Companies like IBM and Digital Equipment were actively not supportive of the Internet. So in fact there was a major struggle to get the Internet supported, Internet development and the building of testbeds initially.

Should I keep going for a few minutes?

**Jennings:** Yes, please.

**Landweber:** So here we are in the 1980s and the Internet is really a stepchild and not very far along. Well, myself, Dave Farber, a couple of others proposed CSNET<sup>5</sup> and CSNET was funded by the

National Science Foundation. Soon after, I went to Bob Kahn who was the DARPA person (of Cerf and Kahn, who first conceived of the TCP/IP protocol). Bob gave us permission to set up international gateways so that email and other connections from other parts of the world would allow data to flow into the U.S. networks including the ARPANET and other Internet connected networks. One of the very first connections we made was to Germany. I never throw anything out so I have early email from 1983 that I think is the first email I got from you, Werner, asking about a connection to Germany from CSNET. And we approved the gateway and worked on it. Now there were problems. Werner has talked about the technical problems. I mean everything was flakey. The software we had for supporting Internet protocols was not robust. The network connections were not robust. As you heard, he had to tie together a satellite link, and X.25 links and then go across to the United States and use this PMDF which was mail relay software. So it was not trivial technically.

But I guess as hard, maybe harder were the political problems. So, in the United States, Stephen Wolff gave us permission to have the gateway to China in 1987. What was not mentioned was the next day he told us permission was revoked. It was the White House that had intervened and told Steve that permission was not to be given. And Steve had this wonderful philosophy which helped make the NSFNET so successful. Which was, you don't ask permission in advance. You ask forgiveness afterwards. And so he, I think, maybe winked at us and we also decided well it's just the White House and we're academics. The White House, we can ignore them. So we actually ignored the order to turn off the connection to China and that was something that I think was very important.

But then there also were political problems that we experienced with Germany which maybe Werner is not completely familiar with. I was getting messages from DFN, the German National Network. DFN was 100 percent behind the OSI effort. Very, very large amounts of money were being spent by DFN with German industry and universities to develop the OSI protocols. Sometime around 1986 or 7, I started getting messages from DFN people asking us to disconnect the gateway to Karlsruhe and connect directly to DFN. My view is that you support the people who have done the work and who are the good people. And in fact the workshops that I organized each year were set up to bring the visionaries from each country together, the people who really were beginning to investigate the Internet. In Germany that was Werner Zorn. And so CSNET refused to do the disconnection. I never throw anything out so I went and read all the emails which were asking me to do that. So there were political problems also. We learned a number of lessons from this activity.

**Jennings:** Daniel, can you pick that up because certainly I remember the protocol wars. One of the astonishing things was not just the amount of money that Larry has referred to, but the viciousness, the interpersonal fighting that went on. The people were trying actively to disrupt non OSI actively. Daniel, do you want to talk a little bit about that?

**Karrenberg:** OK, I'll talk a little about that but I won't go into the fighting part. But first just to explain a little bit the question about "Was it obvious?" No, it was not obvious. I was in a place. I was a student, an undergraduate student in Dortmund. The only thing we wanted was email. We didn't have any sort of political agenda or whatever, no vision. We just wanted email. We did not have any money. We still wanted email. And we found some allies in the Computer Science department there. They had some visiting professors who actually said we will only come to Dortmund if there is email. This was in 1982, I believe '81, '82 timeframe. And we were also running Unix at the time which wasn't quite so popular and we were only allowed to do that at night. During the daytime the computers were used for serious purposes. In the evenings we could do Unix.

And at that time we heard about this Unix network, this UUCP network that was going on. We had all the software, so we didn't have that problem. But how do you connect? How do you connect internationally? The only way we could do that was through the telephone, very much like Werner's first attempt to do the China thing.

We had a little bit of an easier task because we only had to connect to the next country, the Netherlands. And we did that. We found some modems and connected to them and got our email and our net use.

At some point the phone bills were so significant at the departmental level and questions were asked. And we explained and that was fine. Then other places in Germany running Unix also wanted to connect and they connected to us. This was purely 'store and forward'. Your email mail would take a day to get somewhere because it had to be written on one computer, stored there. They had to make a telephone connection, stored on the next computer, store and forward. We could have email conversations with like-minded people in the U.S. for instance that would be a message a day. But that was tremendous. I mean compared to postal mail and so forth. That was fine.

At some point this grew and I remember very vividly how we were trying to find ways of actually keeping it going financially. It was very, very difficult in those times. And if you are sitting in an institute like this, it's hard to imagine but twenty years ago, more than 20 years ago universities were basically state institutions, run by state rules, run by national rules and run by civil servants. It was incredibly hard to take money into those places, especially if it wasn't like for big projects, it was just to pay the phone bill. And so we had to overcome that kind of thing. And the next thing was we had to break the law because at some point we wanted faster speed and automatic dialing so that when the international phone rates became cheaper, I think it was 10:00pm or 11:00pm at the time, we would not have to go into the computer room and actually dial Amsterdam. So we wanted an autodialer and we wanted quicker modems. And it was actually on the statute books a crime or an offence, I'm not sure. The title of the law, the German title of the law is Fernmeldeanlagenengesetz I don't know whether it still exists. But it was a criminal offense to connect anything that was not approved by the state run PTT to the telephone network. And we were doing like ok do we really want this? There is approved equipment but it is way beyond our budget. So we went to our director, Dr. Rudolf Pater, who is one of the other unsung heroes of this and said we have this problem. He said, "ya, we don't have the budget." We said we have this other solution. We know it works. We know it won't break the phone system. They use it in the Netherlands. Can we use that? And he said, "I don't want to know about it." So we said we want to buy it and it's not that cheap. It was like about what today would be 2 or 3 personal computers worth of money. And we said we have already talked to some of the visiting professors and some of the other academics and we will just all chip in and we will buy it. He said, "Na, let me see." And then sort of magically a week later we were asked, what is the specification of this stuff? Where can we buy it? And it was actually bought with public money. And I never know what it was supposed to be that we ordered there. That kind of stuff. And that kind of stuff is really the resistance that you have to overcome. And then the criminal offence too. And all these kinds of things. And of course, we also had this experience when this grew and had like 50, 60, 70, 80 places connected in Germany, we faced resistance like, "You are not doing the right thing. You are just making things work. We want to do the politically correct thing." And we were a bit more resilient to the kind of approach that Larry just related because we were actually funded by a big number of participants and we weren't in that sense part of the academic establishment. But it was quite clear that there was tremendous pressure put on the university to actually either stop this altogether or play it down. Dr. Pater was one of the people who actually

resisted that.

Can I do one more minute?

**Jennings:** Yes, please.

**Karrenberg:** One day, we have this meeting every week to see how things are going with the networks thing and he goes I got a letter from the dean of the department. He commends us on our good work facilitating the visiting professors and all that kind of stuff. And he is really happy with what we are doing. This is fine.

At the same time I was in another function. I was a student representative in university government. Two weeks later in my pile of papers this same letter appears. And at the end there is a paragraph that says, “and by the way you are not supposed to become the German central hub of this.” So I see this and go hmmm and take the letter and go to Dr. Pater’s office and say, “Hey, did you miss the last paragraph?” And he goes like, “One, two, three, ... Daniel, I chose to ignore that.”

**Jennings:** Steve, tell us about what you chose to ignore.

**Wolff:** It was not as much a matter of ignoring things as trying to make it obvious to the right people. You see, by the time I got to the NSF after Dennis had broken the soil, the notion of the Internet was obvious to computer scientists because they had CSNET. They knew it worked. They knew what it would do. It was obvious to university IT departments because they had BITNET. They knew what it could do. And it was obvious to computational physicists because they had MFENET and NSFNET and they knew what it could do. But in total, that’s a very small population. And in fact people who ran much of the NSFNET, the regional networks were based in state run universities and many of them had bet their careers and their jobs on making the network work. So part of my job was to make it obvious to the people who gave them money. So I spent a great deal of time talking to associations of state governors, to a group of comptrollers of states telling them that the money was not being badly sent. So most of my job was actually marketing, trying to convince people that this was a good thing and the money was not being wasted.

It seems as though each consistency had its own vision of what the network was going to do. I’m not sure what computer scientists thought about it. It was very clear what IT professionals wanted from it. And, it was perfectly obvious what computational physicists wanted out of the network. And they haven’t changed in twenty years. They wanted more, faster. But what is clear to me now is that the essential thing is that everyone has a vision. The hardest part of my job was trying to communicate that vision to sufficiently many communities so it would catch hold somewhere.

**Jennings:** Werner, let’s come back to you. Tell us a little bit of the battle in Germany.

**Zorn:** Larry told something about the political pressure in the ‘80s. When we started with the services, we expected that everybody would be happy in the German networking community. But especially in the German Research Network, the DFN, just the opposite was the case. I asked myself, what, what is going on here? We succeeded in our project but then those who gave the money or has the job to do that refused to accept that. That was the signal that something is wrong in the system. I was convinced that if their position is wrong ours must be better or right. So it was really a thing between right and wrong. And of course we were fighting for our way. Steve’s philosophy, Larry told

us, was, don't ask for permission before but ask for forgiveness after. It was the same thing except I did not ask for forgiveness. It was a criminal act to sign the contract with Larry. Perhaps I did not read it completely, but on that little sheet of paper was written that you are allowed to use our software and install it and run the services for the whole Germany. So that was the thing that we were the only one, the only installation, as Daniel had been in Dortmund for the Unix community. And that was the thing that upset the DFN who thought they were the institution, the only one being legalized to do that job. That was a total misunderstanding of what open system means, by the way. Open system does not only mean to use open protocols but also to let the things grow bottom up and not any more top down. That's why we were convinced we were right with our approach and Larry backed us of course. If he would have drawn the plug we would have been lost of course.

But on the other end, from the technical side we were faster developing the infrastructure than they could follow. That was the real thing. Right? If you have an isolated service somebody can say migrate it to a different installation. Move it there and hosting is done there the next day. But it became so complex. Perhaps it was visible on one of the charts, what was the route that the GND was supposed to take over. They refused. Because they said they were not able to run it without any interruption. It was clear if the email service would not run for two days the users would really give, run a big protest. And so we worked in parallel and then reached the good end where we moved to the full Internet suite in 1989.

And then we thought the game is over, the battle is over. But then DFN moved to TCP and did the same game but then concentrated on Dortmund and really got vulgar with DENIC, the registry for Germany. Then the Dortmund people had to fight and I could observe what happens.

A mixture of thinking, having the right vision or the right way and doing technical development faster than them helped us to survive.

**Wolff:** Your biggest sin was success.

**Jennings:** This is the extraordinary thing, that Steve just said is that the biggest sin was that everyone who was doing this work at the time was doing it sort of unofficially outside the official European government, European Union funded Open Systems Interconnection approach to networking and outside the approaches that were approved by the PPTs.

Let me tell you just a little bit about the PPTs. Back in '83 when the early EARN leased lines were connected and that's EARN, the European Academic Research Network, the European part of BITNET that I was involved in. The France Telecom installed their end of the line to Rome, one of the major links and they issued the bill for it. But they refused to connect it because of the issue called "passing of third party traffic." It was against the law for one party to take traffic, a party, the third party, to take traffic from the first party and pass it on to another party. Get this right. To take first party....

**Karrenberg:** It was illegal to compete with the PPT.

**Jennings:** That's the summary. It was illegal to compete with the PTTs in every aspect of communication. In fact in Ireland the law was so written that technically it was illegal to speak and to use the air between people to communicate because that was actually covered by the communications act. So it was a regulatory environment that was very hostile then to doing ad hoc things that actually worked and that continued on.

Jay, as a historian what lessons do you draw from this early history of the 80s?

**Hauben:** I think the lesson to draw is to realize that first there was a vision, a deep vision, from JCR Licklider and the people in the 60s. That vision was of the Intergalactic network. Somehow, by connecting a few, you were eventually going to connect everybody. But it's also true if anything good ever happened it is because some good people worked very hard over a very long period of time to overcome the obstacles. I think we know something real happened because it was so hard to get there. I think each of these stories contributes to the fact that despite the obstacles people have an understanding that what they are doing is sufficiently valuable and important that they will continue trying to do it. The job for the historian to gather up these pieces which are not very well documented and put them together to show the grand flow that has come forward.

The surprising thing was that when Werner told me the China email story, it was a good story but is it exactly accurate? So I looked on the Internet and in books. I found that there was a totally different story being told that didn't have an international component. For whatever reason, the main essence of the first email China story, which was that all of this activity was international, was missing in the telling of it. To clear that up it required digging. When I dug I found Werner was telling it straight.

I think the value of what we are doing here is we are hearing from some of the pioneers. So we are getting the clues of how to get the history right. It is very important that the stories be known and be told and be gathered up. So I hope there will be more panels like this one.

**Jennings:** Excellent. Larry, tell us a little bit about the Landweber Networkshops because those networkshops were key.

**Landweber:** Go back to 1982. I went to a meeting in London that Peter Kirstein had. And I hadn't traveled very much and I decided, gee wouldn't it be nice to see more parts of the world. I had been a theoretician. Mostly I went to one conference a year or two conferences a year. But now I had gotten involved in CSNET and had switched my work to networking sometime in the 70s. And it was exciting and by coincidence I started being in contact with people around the world who were thinking about national networks, sometimes the Internet, sometimes like EUNET, and sometimes EARN, BITNET and there was no easy way for people to communicate. So what I did was try to identify one or two people in each country. As we went along the number of countries expanded. So that we brought them together once a year in a nice place and spent several days exchanging ideas, exchanging software, talking about plans and it was a way of supporting the continuing development of the network. Daniel was at, you were at a couple of these, right? I think Dennis was. I met Dennis 1984 in Paris and Werner was and Steve was (were you at, no maybe you weren't) 1984. And so gradually, first it was people from North America and Europe. Then there were some people from Latin America. Then there was Kilnam Chon from Korea, Then there was Jun Murai from Japan. And then there was Florencio Utreras from Chile, etc., etc. We just gradually—Juha Heinänen from Finland and gradually we expanded and it built a community and that community was very important for sharing ideas. Might I add one more thing?

**Jennings:** Please.

**Landweber:** OK. For me all of this has a real important geopolitical, economic, global lesson. And

it is that governments have no role in deciding which technologies are superior to other technologies. That's the lesson. In the case of the OSI activity, governments around the world spent billions of dollars in an effort to build a technology that was poorly conceived and not well executed in planning it. They very actively objected to and worked against the Internet.

Now, a former student of mine was at the European Commission and at one point he was in charge of supporting networking at the Commission. I always used to make a point of thanking him whenever I saw him because through his efforts he helped American industry. I mean, if you go back to 1980, U.S. industry, European industry, Japanese industry were on an equal par when it came to telecommunications. Governments around the world by suppressing the creativity of their industry relating to the Internet made it possible for the major companies in the Internet field to initially develop in the United States. And I think it significantly for a period hurt their economies. And so this is something I hope will be written some times by historians as a lesson. There is a wonderful paper by François Fluckiger from CERN which discusses this. It's about 10 years old,

**Jennings:** Fifteen

**Landweber:** fifteen years old which actually talks about the European experience. That's the lesson, the global lesson that I have from this.

**Jennings:** Steve, pick that up. Governments shouldn't mandate technology? Isn't that what we did in the NSF? Didn't we, didn't I go around and particularly say it has to be TCP/IP?

**Landweber:** No. No.

**Wolff:** But we did that. Yes. But we were lucky.

**Landweber:** May I interject.

**Jennings:** You may.

**Landweber:** There was a battle. The NFSNET by accident became Internet. There was a committee and if there was a battle, the physicists wanted DECNET. They wanted to have connections from their universities to supercomputer centers and they wanted DECNET. They didn't want Internet. There were a few people, like Ken Wilson, the Nobel Prize winner who wanted Internet. And so there really was also within the U.S. government.... You were there when that was happening.

**Jennings:** I fought that happening.

**Landweber:** and so it wasn't obvious that Internet was going to be the backbone of the NSFNET.

**Jennings:** But Steve

**Wolff:** No, it wasn't obvious. But it was a battle that, Dennis, you fought and I fought as well because I think it was clear to us where the smart people were. It is usually a good bet to ally yourself with intelligent people and it seemed to us that the most intelligent people were those who were

explaining why TCP/IP were good protocols and what the difficulties were with DECNET and the other various protocols which were being touted at the time.

But I wanted to say something to Jay. I am trying to remember the source of a quote which I think is relevant to your activities. It's from a German author and I do not know the German but the English translation goes something like this: Those things and deeds which are not written down are condemned to oblivion and given over to a sepulcher of darkness.

Larry, I am very grateful to you for not having thrown anything away because the original source material is all that we have to reconstruct the actual history.

**Jennings:** Daniel can you give us a quick comment because it is coming towards the time. Given that we have talked about all the difficulties, all the battles, how did the Internet actually come to Europe?

**Karrenberg:** Oh, that's a tall order. [I think] Let me deviate slightly but still have some essence into the story. I think it came many, many ways. The thing about, one of the reasons the TCP/IP protocols were better than others is that they allowed the network to grow without any central authority, without any central control, central network center, or whatever. And so people made a link here, a link there, a link there. Werner converted his links to the U.S. I think at some point to IP. We did the same. At some point we were just doing the store and forward thing I talked about earlier. And then it became economical to buy actually leased lines. Then we had the leased lines it was quite easy actually, it was like flipping a switch to put TCP/IP on it. And we didn't have to ask anyone in the U.S. permission besides the people that we were actually talking to. Whether we could connect to the NSFNET and things like that was a different thing. But just to have this TCP/IP link, was just you call them up or send them an email actually and say hey um tomorrow at 10:00 we switch UUCP to TCP/IP and PIP and that was that. And then when we had more links into different countries that became leased lines it was very easy to convert them as well one after another and it grew organically. And somebody else said I have an island here that uses TCP/IP. Let's make a link and connect the islands. The Internet! That's where it came from. So that's how it came. That's the one reason why TCP/IP was better. The other, obviously, is that it did not concern itself so much with the applications like any of the other proposals did. The applications are actually outside in the end systems rather than in the network. The physicists could do their thing over it. The computer scientists could do their thing over it and so on.

**Jennings:** It was an internet.

**Zorn:** For me the approval by the NSF was one of the important things for us to maintain the email service to China. I am sure in China that approval was very little known. There were many other attempts to draw lines and links to CERN and elsewhere. Other groups tried their best to get a connection to some situation they worked with. What would have happened in the whole interconnected networks with BITNET and everything around if the NSF would have said no?

**Landweber:** To the China link?

**Zorn:** To China. Politically "no." Like you say, no nothing to North Korea, nothing to .... Was it policy to control every network with every exit and whatever in China? Without permission, it would

be thrown away and the links would be cut or what?

**Jennings:** Let me address the question and see if people agree with me. I think what would have happened, it would have been done anyway. Following Steve's maxim, Yes it was nice to ask for permission and yes it was very nice to get the permission. But I think back then we would have done it anyway and then asked for forgiveness. And I think we would have gotten away with it.

**Wolff:** Do you suppose I didn't think that? {Laughter}

**Jennings:** Maybe we recognized it was going to happen anyway.

**Hauben:** I don't know if anyone would have paid attention. Who down the line would have actually said, "I am not going to pass on the email message that's come. I am not going to do relay these email messages any more." I don't know which human being in the chain who had invested so much of his or her time and energy and spirit would have said, "OK, I'll be the one who doesn't continue it."

**Landweber:** If there were not even the hint of the permission and if, remember we were depending on the Defense Department

**Jennings:** Yes

**Landweber:** Bob Kahn had I think a very similar world view to Steve which was things happen and he was hoping the network would grow. But if his bosses had learned of it, the people who are the real military people, they could have made us stop.

**Jennings:** They were scary people back then.

**Landweber:** There were plenty of people and there were countries where we would not have attempted. We would not have attempted a link to North Korea for example in those days.

**Jennings:** Steve.

**Wolff:** One of the consequences might have been that it would have taken longer for what happened in 1994 because the precedent set by getting permission from the United States government for an interconnection. I think and only Madame Hu can speak to this but I imagine it set the stage for certain things to happen within China so that later when the formal, basically the IP connection was sought that was a very formal ceremony and it was an actual agreement between governments. And I think that might have taken longer to happen if the stage had not been set by the first connection.

**Jennings:** So Madame Hu, do you have some comments on the battles these people fought to get the Internet going?

**Hu:** The description of the early days when the Internet entered China may differentiate depending on the different events the different individuals had been experiencing at that time but the main

stream is quite clear that the scientific research and international exchange played the role of the engine. Also we should not leave out the High Energy Physics Institute of CAS, with their partner, the SLAC in Stanford University. The earlier digital communication between the latter partners took place even for 1 year ahead of the first email sent by Wang Yunfeng and Werner Zorn and their teams to Germany, via an X.25 telecommunication link.

Looking back to 1994, at that time my feeling was the obstacles were not in the technology. Because the key person of our technology team, Professor Qian Hualin and others, told me that they had full success in the test with Sprint. There were no technical obstacles. Everything is ready. Just the gate is still closed somehow. So I remember very clearly when I came to Dr. Neal Lane, the NSF Director at that time, to ask for help. That was in the early April, when I was in Washington DC as a member of the China delegation attending the U.S.-China Combined Committee Meeting on the collaboration in Science and Technology between the two countries. Dr. Neal Lane immediately made a chance for me to talk with Stephen Wolff. Stephen just told me, “Don’t worry. No problem. You will be connected to the Internet.” I was not very sure about that. I asked him, is it that simple? He said yes it is simple. No contract, no sign, no document, the only document we had provided before that was the AUP (Accepted Use Policy. And then after a few days I got the news from my colleagues in China that the connection is done, it goes through smoothly. Everything is OK. Then I thought, “Oh, Steve Wolff is really great!” This man had a magic stick. The magic stick pointed and the gate opened. Is it that simple? I guess it is.

**Jennings:** On what better note to end.

With all the hard work and all the battles, at the end of the day it took a little magic to make this fit together and to forge the links to China to enable the first email twenty years ago from China to the rest of the world.

Ladies and Gentlemen, Panel, thank you very much indeed. {Applause}

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\*Transcribed from the video at:

[http://www.tele-task.de/page50\\_lecture3204.html](http://www.tele-task.de/page50_lecture3204.html). Slightly edited by some of the participants.