



The COOK Report on Internet Protocol Technology, Economics, and Policy



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Reframing Telecommunications Policy

Erik Cecil Describes Why Net Neutrality Doesn't Solve the Real Problems and Offers an Agenda that Is Implementable and Would Free the Economic Productivity of Device Owners

Editor's Note: From 2004 - 2008 Erik Cecil worked for Level 3 as an inside attorney handling intercarrier issues. Erik also handled administrative litigation, including two massive cases tried before state regulators, several federal trial level courts and in federal appellate courts related to Level 3's interconnection arrangements with incumbent local exchange carriers. After leaving Level 3, Erik founded Regulatory Cost Management LLC, (<http://www.regulatorycostmanagement.com/index.html>) a consultancy focused on telecom expense management for carriers and enterprise customers, and, as of his admission to the Colorado Bar on Oct. 26th, Erik is returning to private practice holding law licenses in Colorado, Washington, D.C., Maryland. Erik is also admitted to the U.S. District Court for Colorado and the 9th Circuit Federal Court of Appeals. He occasionally blogs at <http://www.erikcecil.com/>.

Introduction and Summary of Erik Cecil's Position

During the first half of October we had a debate about the future direction of net-

work neutrality policy on my private "Architecture and Economics of IP Networks" mail list. The interview with Erik Cecil that follows emerged from that debate. He shows an intelligent and creative way of approaching a very bad environment. Erik offers a revolutionary approach that I am increasingly convinced is possible.

He argues that the reason coming approach to a rule-making on network neutrality is nothing more than an appearance of an effort to resolve the contentious problem - an effort that really solves nothing. At the core of his contention that the Network Neutrality debate solves nothing is the insight that such FCC action would leave all Internet Protocol (IP) traffic positioned within the "enhanced service provider" unregulated exemption where transport services were also wedged in when the last of

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their common carriage protection was removed in the summer of 2004.

Other than permitting the extension of the current situation where 50 state PUC's can also bring would-be Internet protocol competitors of the Bells before them and effectively fine these companies out of business, such a new move by the FCC - one that essentially tells the incumbent monopolists to "be fair" would have no real effect. Why? Because, with the 2004 FCC move, the Bell's unregulated IP opera-

On the Inside

Open Sourcing
Regulation?

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page 71

tions are now being subsidized directly and indirectly by 50 different state PUCs. Over time, these state commissions nearly always force would be competitors to subsidize incumbents' regulated operations even when incumbents use regulated facilities to compete directly with competitive networks providing IP-based services.

So what should be done? Can it be argued that a true public interest solution to the problem and one that might give President Obama a shred of credibility for a change would be for the FCC to say: wait a minute the only solution to the problem with neutrality is not a clumsy rulemaking but something embedded in statute and that we therefore rule (and ask Congress if it deems necessary to pass a statute agreeing) that the Internet protocol is to be treated as telecommunications under the earlier FCC computer findings. If IP bits are telecommunications, then telecommunications is also interstate traffic used in interstate commerce and therefore in the exclusive purview of the FCC in regulating communication among the states.

Regardless of one's political disposition we could then get back to a situation where we guide telecommunications policy solely at the national level rather than both at the

national level and at the level of each and every one of the 50 states. We must do this because then we cannot afford to have the nation's capital, and its policies, and its investment subject to the regulatory and largely protectionist imposition of additional costs by every state utility commission.

Furthermore, cloud computing, if it is to have a future, must be established under a set of national standards not national rules subject to 50 separate ongoing acts of state adjudication. We must do this in order to be in a position where we use our revenues soundly if we're ever to climb out of the hole brought on by the Wall Street disaster of last year.

The Origin of the Problem

Telecom-wise how did we get in the hole? We got there by emulation at the state and national levels of deregulation mania inspired by 30 years worship of the Chicago school – or what Mark Cooper calls Free market Fundamentalism.

The catalyst was a June 29 2009 talk before the National Association of State Utility Consumer Advocates at its

Boston mid year meeting, Lee Selweyn, a well known public advocate attorney showed how well he gets regulatory subterfuge.

For me his most powerful slide was.

The aftermath of telecom deregulation

- **FCC deregulated for deregulation's sake**
 - **Confused MEANS with ENDS**
 - **No goal other than deregulation itself**
 - **No benchmark for judging success**
 - **No process for ex post evaluation of outcomes**

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from <http://www.nasuca.org/Selwyn%20Slides-pp%20Boston.ppt>

On October 6th on the economics of IP Networks List, Eric Cecil started a debate on why Selwyn's presentation helps to explain how network neutrality is an imaginary solution to the problems of telecom deregulation. See also

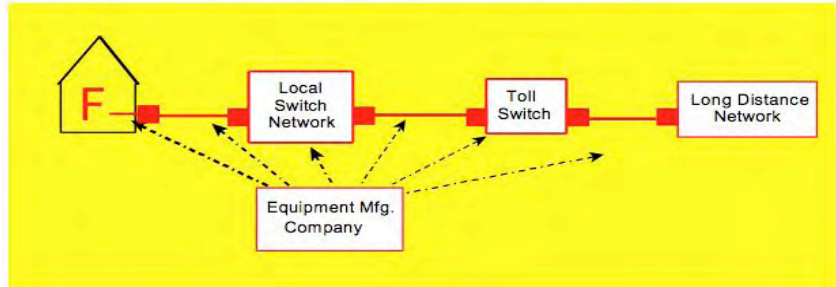
www.erikcecil.com/.../net-neutrality-is-deregulation-20-and.html - [Cached](#) -

NET NEUTRALITY IS THE LAST NAIL IN THE COFFIN OF INNOVATION and COMPETITION AND THE INTERNET:

To really understand this, you'll have to actually look at

[Lee Selwyn's economic analysis](#) of the present state of telecommunications markets. Selwyn's concepts are surprisingly simple: We have a duopoly. We got there via deregulation. And now, magically, the FCC is going to fix the symptoms of duopoly – namely the incumbents' leveraging control of bottleneck plant to extract monopoly profit - without addressing the underlying cause at all -- **which was its rampant and asymmetrical deregulation of the entire communications industry.** (Remember, Net Neutrality is not about law or even a formal FCC Rule; it simply amounts to the FCC saying, "Hey, I really mean it this time"). But it is actually worse than that. The appearance of a rule can be more harmful than no rule at all. Here's why, but first of all --

The Shrinking Natural Monopoly: Pre-Carterphone (before 1970)



| | | |
|---|--|--|
| Monopoly Franchise | Telco Owned - Closed | Non-Telco Owned |
| Competition | Telco Owned - Open | |

19. [Editor - two pages below]

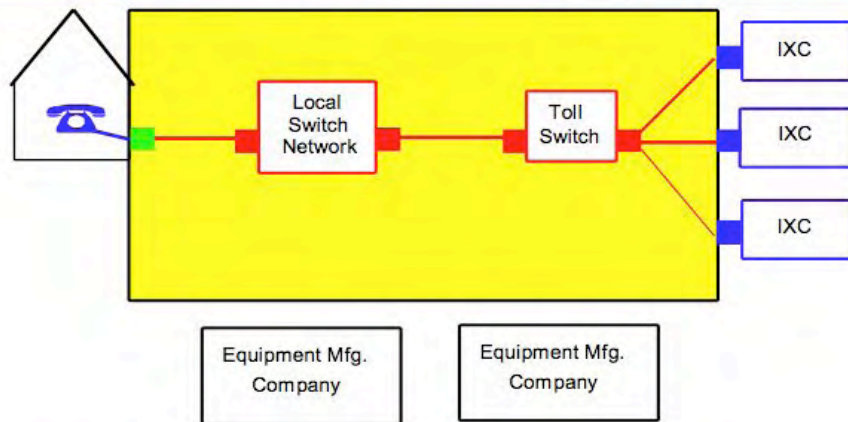
Ma Bell owns enterprise markets: as Lee points out and as GAO has told us for years, there is zero competition for access. Rather, because Bellco was allowed to suck all of the money out of

AT&T (before remonopolization) via thousands and thousands of state PUC and FCC decisions that kept turning back the clock of technological progress by fining [those who would compete with Bell] for failure to mimic bell facilities, costs, and network layouts [. . .] we see, in raw

LEGAL GLOSS ON LEE'S POINTS RE: HOW WE GOT HERE:

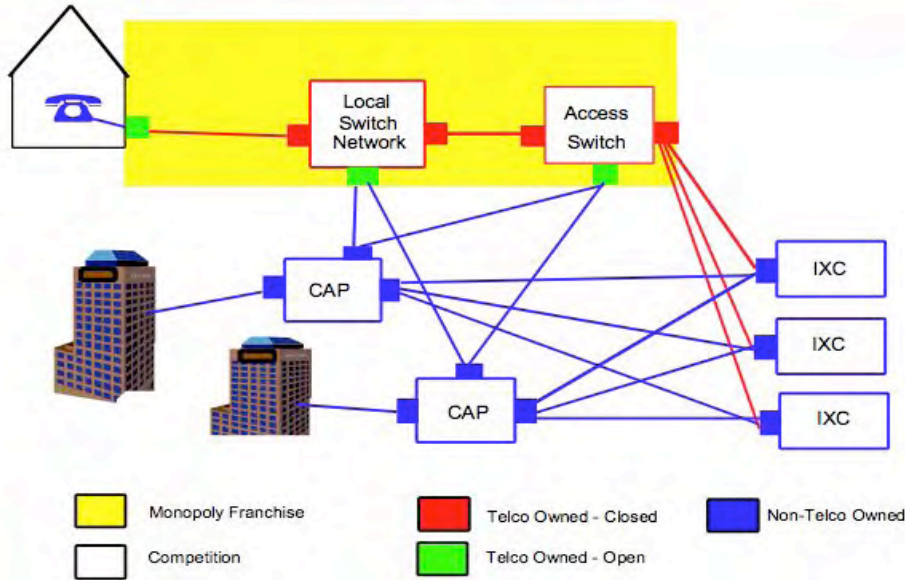
The Shrinking Natural Monopoly - slides 12-15. Lee shows money impact on network and results. Lawyers have told you forever that when you deregulate bell retail while simultaneously forcing competitors to subsidize bell retail monopoly results. Thus, slides 17, 18, and

The Shrinking Natural Monopoly: Pre-divestiture (before 1984)



| | | |
|---|--|--|
| Monopoly Franchise | Telco Owned - Closed | Non-Telco Owned |
| Competition | Telco Owned - Open | |

The Shrinking Natural Monopoly: as envisioned by TA96



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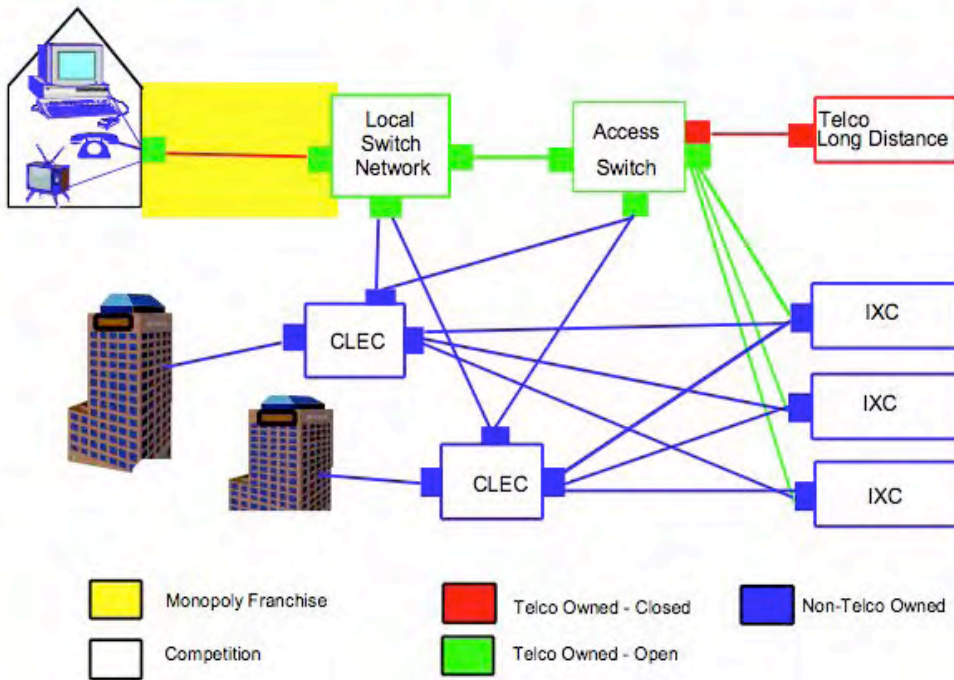
14

terms the result (cf slide 17 AT&T before SBC acquired them and AT&T after - slides 18 and 19 - on page 5).

Edge Duopoly - slide 20 [Editor on the third page below] - these facilities, for all intents and purposes are totally deregulated.

Everyone pays the loop owner even if the loop owner is supposedly deregulated in a "competitive" market.

The Shrinking Natural Monopoly: as envisioned by the Powell/Martin FCC

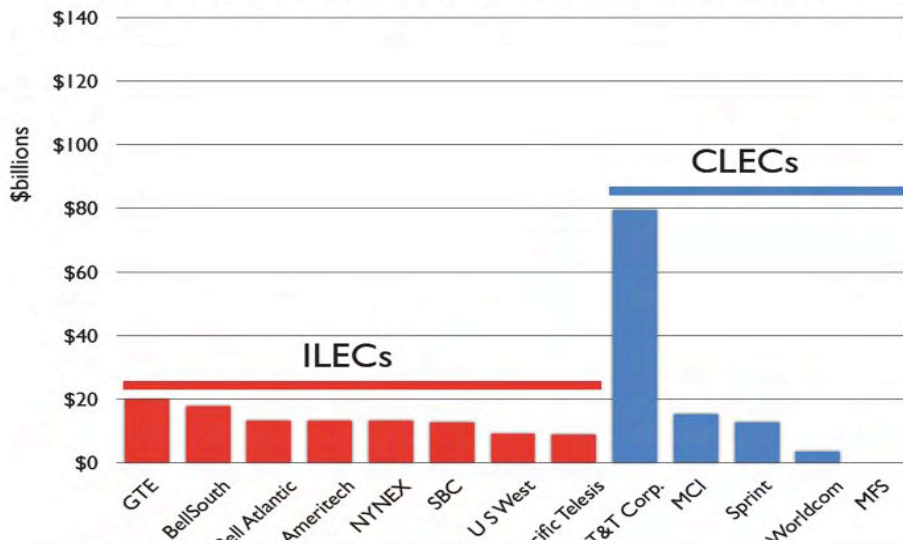


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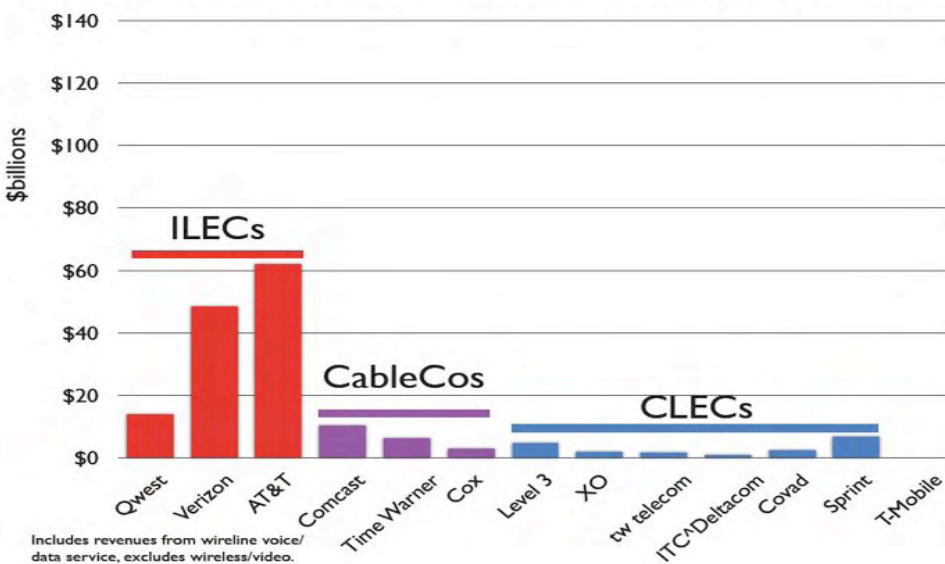
15

No one, not even Google, can deploy any form of competitive network that exchanges voice traffic with Ma Bell without mirroring ALL of MA's "costs" and network configurations ACCORDING TO RETAIL RATE DESIGNS BASED UPON THE ORIGINAL BELL DEPLOYMENT PATTERS

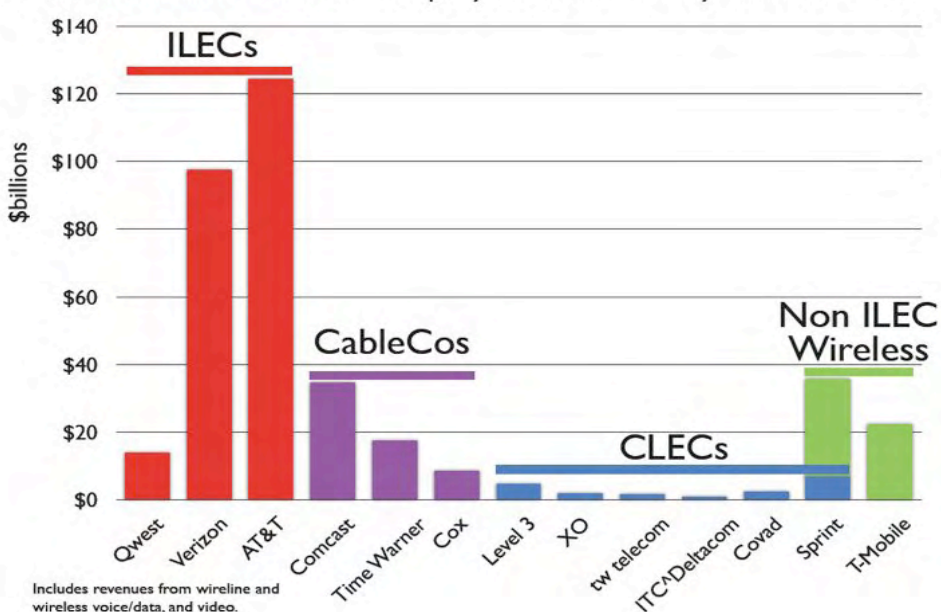
Concentration of US Telecom industry Revenues - 1995



Concentration of US Wireline Telecom industry Revenues - 2008



Concentration of US Total Company Telecom industry Revenues - 2008



UNCHANGED SINCE THE 1960S.

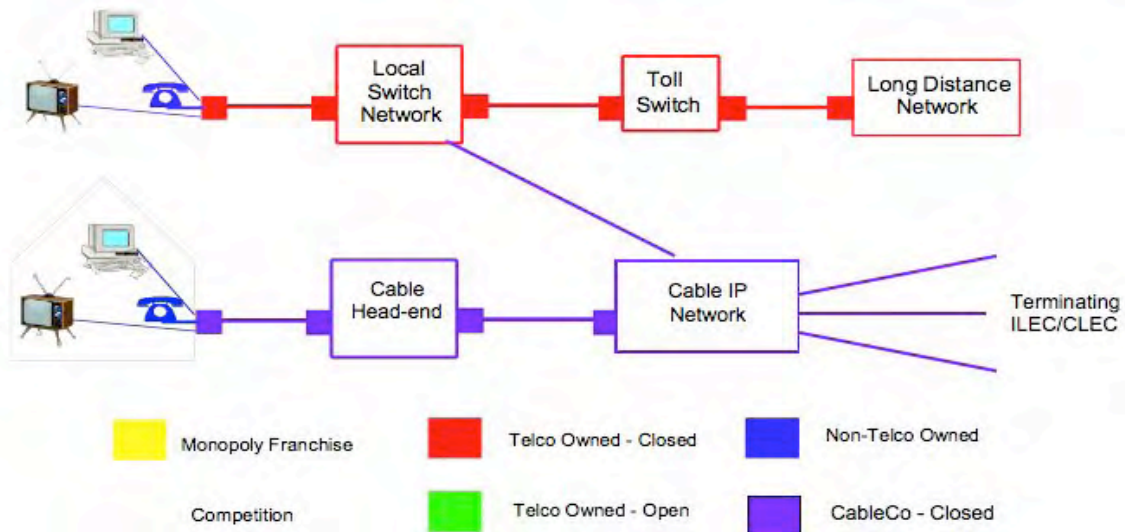
Competitors - any facilities or any form of voice that touches Bell - fund ancient Bell network costs even if Ma, herself is using the latest low cost distributed softswitch technology supported by low cost fiber optic. Worse yet, we, the ratepayers paid for that fiber optic. Only Bell gets to use.

Meanwhile, Bell "retail" of course is effectively deregulated but even where it is subject to flimsy price cap regulation, the only markets regulators pay any attention to - or can pay any attention to - are the least relevant. So the subsidies continue to flow from ALL of us to Bell landline, which also happens to support Bell Long Distance, Bell CMRS, Bell "Internet" services, and so on. This is YOUR money, Oddly, competition was supposed to be how different is better, not how different and better funds ancient while ancient uses regulated subsidies to build out their own brand of different and better.

B. HOW NET NEUTRALITY GIVES THE BELLS THEIR SUBSIDY CAKE AND THE INTERNET TOO:

First, it changes nothing mentioned above. To fix any of that you'd have to do two things simultane-

A Mass Market Cable/Telco duopoly



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ously: declare any IP transmission to be "telecommunications" and completely preempt state regulation. Under a legal system that continues to pretend that distance has any relation to cost - which we know to be patently untrue by the simple fact that the Internet carries exabytes of information worldwide, but somehow an enormous number of us can still afford some form of connectivity - no network can be rate or service regulated at the state level and not suffer severe economic harm (unless you text without an unlimited plan - then you taste the economics of landline Bellco thinking as applied to bits - \$5,000+ for the equivalent of

a single iTunes song download). Unless and until this is fixed, state regulation will continue to be monopoly's best friend.

Second, Network Neutrality cannot even begin to fix the problems it pretends to be able to solve.

The reason is simple. Anything that's transmitted in Internet Protocol is magically deregulated. I argued a ton of those cases myself and know full well why that was the case: it was [with the enhanced service provider exemption more than 30 years ago] a policy choice by the FCC designed to protect [what became] the Internet from Bell domination

COOK Report: You are saying then that, if Google Voice wants its services ubiquitously available, it cannot use any PSTN facilities unless it builds its own network based on century old TDM telco technology? Since it could not afford to duplicate the telco network, it must buy the capability to connect its customers from wholesalers who will sell them the needed minutes?

Cecil: Right. Except there will be so many fees as to render the exercise suicidal. What Bell charges in effect since anything with IP is utterly unregulated subsidizes the rest of their operations. The distance that a voice call travels on an IP network is

irrelevant. From a pure technology and cost point of view, long distance and local access calling areas are irrelevant areas. We are still subsidizing these guys – not only do they get direct subsidies, they get all kinds of market protection.

COOK Report: So what you are saying is that the state PUCs will prohibit the interconnection of an IP-based CLEC network with ATT or Verizon if it does not have the same TDM copper based infrastructure and infrastructure that would be 10 or 20 times as expensive for the CLEC to build as an IP infrastructure -- a task that would make it impossible for the CLEC to be economically viable?

Cecil: Yes. Nearly every state PUC that has examined the question of IP networks versus old Bell telephone networks has basically said that if a competitor did not install their own TDM switch in every local calling area in the same way that the incumbent did, regardless of whether that had any effect on your ability to deliver service, there, we deem your traffic illegal.

What Net Neutrality Is

Network neutrality is well-intentioned manipulation of

existing FCC rules. It does solve a few things in the near term. The Obama administration cannot look like it is in the pockets of ATT and Verizon. By saying it will enforce Network Neutrality it is standing up against them despite the fact that such enforcement does nothing about the incumbent monopoly. And note that I am saying monopoly -- monopoly because cable is tiny compared to the gross revenues of the incumbents.

All the FCC is doing is playing around with the rules right now trying to smooth out some bumps in the market. Net neutrality is like "nice try" but the problem in what you are doing is that **you are trying to create common carrier rights out of an exception to common carriage.**

IP has enjoyed the enhanced service provider (ESP) exemption from Common carriage requirements for decades. You are not a common carrier if you are an ESP provider. This goes all the way back to IBM's original need to connect its mainframes to the phone network to make them truly useful. Back then ATT was the only common carrier.

If IBM wanted to interconnect it would have had to have built an ATT like network in order to acquire common carrier status. ATT would have

cannibalized IBM before it could have done that. So the FCC created the enhanced service provider exemption to common carriage and said you have to connect IBM as a special case.

Device Owner Versus Wire Owner

You see everything that is old is new again. Try not to get lost in the details. It is the patterns that matter. **The pattern is very simple. It is computer versus the guy who owns the wires.** At first computers were giant, clunky, rare, and expensive. But then all of a sudden they went every where. But remember the law is 40 years behind the technology – so we are still playing IBM versus ATT in a world where my MacBook is more powerful than an IBM mainframe.

They guys with the wire want always to extract more value out of whatever it is that the guys with the devices on the end of their wires are doing. They only way they can do this is via fresh regulatory gambits. But remember the regulations are only the symptom and not the driver. The driver is the money.

COOK Report: What you just said is great. It is a high level principal that if you grasp it you can apply it from one decade to the next.

Cecil: Yes it goes on. Just go from IBM mainframe to I-phone – it is the exact same dynamic.

The mainframe can't connect because it will do heaven knows what. Then we invent a legal excuse for a mainframe to connect. So go forward a few years and technology gives us a new technology called the private branch exchange and the next thing we hear is: Oh PBX can't connect because of some new reason they invent – it's overusing our inside wiring or whatever. They are very good at coming up with objections.

COOK Report: **So the whole purpose of regulation is to balance the interests of the wire owners against those of the device makers. And thereby ensuring a regime under which devices can communicate?**

Cecil: Yes! That is all it is. Now you see the dynamic – device versus network. Thy devices get smaller and more ubiquitous and network gets more complicated. Well guess what -- so does the law because **the Bell's keep inventing new reasons to extract value from the devices and software that others create.**

They pretend they are justified in taking money from the

intelligence you create to continue to fund stupid networks that not only are not intelligent and contribute very little value outside of connectivity, they don't even invest to upgrade those networks. **Moreover, if and when they do invest, they build in ways that ensure only they can extract value from intelligence. We're paying them to marginalize innovation that others create.** It is beyond insane.

COOK Report: And the reason it is unbalanced is that the regulator had to be there to play jujitsu against the wire owner to give the creator of a new device the chance to use it. Because the wire owner's only purpose in life is to extract the maximum income from the device owner whenever he comes up with new ideas and value and its just a never ending loop?

Cecil: Exactly!! Think of what happened. In the 80s we had to fight like hell just to be able to quit renting telephones from "Ma." And then in the 90s with competition and the internet Ma finds new ways to take money from every device that wishes to connect.

They always win. They always get a cut of whatever new value the edge creates.

COOK Report: Because "unless you can replace *our network*, your edge based devices aren't all that useful."

Cecil: This is what the state PUCs claim all the time. But tell me has that network improved all that much since 1960? Heck no. It is still copper. The same expensive class five switches. That we accept that its okay for a Bell network to use computer technology that sucked in the 1980s amazes me.

Device Versus Wire Encore

Anyway, you now understand the dynamic. It is simply device versus wire. **The whole network neutrality issue is just device versus wire on the same network terms that we have been fighting for the past 40 years.**

COOK Report: In other words the philosophical purpose of network neutrality would be for the wire owner to be prevented from interfering with the device?

Cecil: Yes. At the end of the day if what you have is a lot of competition against Ma Bell at a facility level, then mostly what you want to do is exempt all of the new services from the "Ma Bell like" regulation so those new services can grow and compete with and ultimately replace

“Ma Bell.” This was the original theory of competition.

COOK Report: How could these services be exempted then?

Cecil: First look at the other part of that equation. **Over the past eight years we have pulled the plug on facilities based competition and we pulled the plug on anti-trust. So what happened? Ma Bell swallowed up all the competitors.**

The question really becomes, if the vast majority of the network and the money are in the hands of Ma Bell and Ma Bell effectively has a landline monopoly, and a wireless monopoly and is the largest player on the internet backbone, if these two entities own all this space and everyone else is little blips on the radar screen, then why are we continuing to exempt the vast majority of traffic which is IP traffic belonging to Ma Bell from regulation?

The original IP – ESP exemption was a policy choice to encourage competition.

COOK Report: But note what you just established. Everything that counts now is IP traffic – and IP traffic is exempt from regulation. They have flipped regulatory exemption on its head so that

its continuation ensures the instantiation of the monopoly of the facilities owner in perpetuity.

Cecil: Exactly. That why I would advise Paul NOT to go down the net neutrality route because that is a rule. No matter whether in Australia or the US, we must anchor what we do in the future in the bedrock of the statute. **The FCC under the statute has the power to re-regulate.** Do not base the future stability and productivity of the net under all these rules.

COOK Report: But the wire owner in the end potentially at least always has the upper hand in that it can impede the communication between devices. The network owner is the potential spoiler and, until people understand this, the network as spoiler can always stand up to take bigger chunks of “rent” out of the capability of newer and more innovative and more powerful devices.

Until you find a way to stop the network owner from extracting monopoly rent from its wires, you will never cross the transition chasm into the widespread productive use that Carlotta Perez speaks of as the final deployment phase of the ICT revolution. Until these technologies go into widespread use, you don’t get all their economic

benefits and until you solve this imbalance in power preventing wide spread use that is to say “deployment”, society will never get those benefits. Under wireline owner-extortion you can kiss device innovation good bye.

Cecil: The internet is dead. It’s already over. That’s the bad news.

COOK Report: Certainly the hope we had for it is gone. But consider all the on going interest in cloud computing. As it grows it will certainly be fiber dependent at the network heart. But if it becomes as all pervasive and important as its advocates hope, then connection to it will be as important as connection to the electricity grid. The cloud computing universe will have everything. It will represent “civilization.” Might this be what replaces the internet?

Cecil: Yes - if. Verizon and AT&T are enormous. There is not a part of any market they do not touch. Everyone is beholden to them in one way or another. This is why there is very little fresh thinking going on in the Net Neutrality debate; no one wants to annoy these behemoths. This is why the framing that is so very important.

Remember, the basic insight is -- device versus wire owner. Back in the 80s where a lot of competition

was coming on, it seemed to make sense to exempt the competition from regulation. But then we go through the 2000-2008 period and come out the other side with Ma Bell re owning all the networks. AT&T versus IBM; AT&T versus I-phone; AT&T versus Google voice. It's all the same. The wireowner extracts tribute from the device owner.

COOK Report: The wire owner is a predator?

Cecil: Absolutely. But here is the deepest truth of all. If the wire owner is a predator, why in God's name why would you put a private entity in control of building constructing and operating the wires? Your first answer is going to be its ok to do because they are regulated.

Where Regulators Get Their Power

COOK Report: Yes they are controlled in some fashion.

Cecil: But ask yourself. Where do the regulators come from? They are not judges. They are part of the executive branch of state and federal government. They are subject to lobbyist pressure. When a new Governor is elected, he or she appoints new state level PUC commissioners. When a new president is elected you get new

FCC commissioners. That is why I have kept saying that you cannot put a private entity in control of public property and the wires in it and expect a regulator who is elected directly or indirectly with private money to regulate that private entity effectively over time.

COOK Report: Especially over time. You may get lucky and get a truly public spirited person for a year or two or three. HBut over several decades? An entire string? Unlikely.

Cecil: – Right. And it goes in cycles. If you are a DC policy wonk, you get all excited when you win the presidential election because now your guys are back in power and this is good for your clients. This is natural even for normal every day regulatory attorneys and industry types. In the short term and at a relatively shallow level, there's plenty to get excited about. But if you look deeper, nothing has really changed.

Nothing has changed because once again we have public officials elected with private money in charge of making sure that private ownership of public property (right of way and the infrastructure we've funded for a century) is used in the public interest. Play that out over time; the private interests, by neces-

sity, are always stronger. That's where those who espouse private ownership have it equally right and equally wrong: private ownership alone is just fine. When the public must fund it, and when the regulators are ultimately answerable to the private market, the scales tip too far to the private at the expense of the public.

If you want to see an example of this, just try and tell the state regulators and Ma Bell that we should totally deregulate the entire Ma Bell infrastructure. They won't do it. They won't do it for a very simple reason: complete deregulation exposes them to antitrust liability while simultaneously ending both the subsidies and market protections that go along with regulation.

COOK Report: Yeah – hard to tell where the crooks begin and end.

Cecil: But they are not really crooks. I would maintain that the regulators are stuck in a lousy system. This is the essence of regulatory capture. Look at it this way. If there is monopoly, there is market failure. If there is monopoly in a regulated market, there is regulatory failure. If there is regulatory failure in a regulated market and the original incumbents, whose monopoly regulators were supposed to control,

have not only recaptured all of their old markets, but also all new markets that have evolved since deregulation, then there is regulatory capture.

There can be no other conclusion. Think about it. Bell now owns controlling positions in landline, voice, long distance, wireless, and the Internet via Peering. Several of those markets did not exist at the time of the 1983 breakup, yet Bell dominates these new markets. Regulated competition (remember the Bells were required to interconnect by regulation) was supposed to fix that. Instead regulators abandoned competition, abandoned antitrust, remarkably retained pre-1983 visions of subsidy flows, and, as a result, Bell owns the world. If that is not regulatory capture, nothing is.

COOK Report: And when the party in power changes, the new guys want to undo the "damage" that the previous group did.

Cecil: But Obama had to get elected. His campaign had to take checks from ATT and Verizon, and the rest of the market, as did every Congresscritter out there. That is how you get elected. We need election reform but we won't get that anytime soon. **And meanwhile regulators are in effect still being**

elected. What I am trying to do is make sure they do the least harm possible when they open all of this up.

If then we live in a world where the private property owner controls public property and we have publicly elected officials that elected by contributions private property owners – under these conditions we are not going to get to fiber optic cloud utilities. Rather we will see no more than variations on the same fundamental themes common sense tells us do not work.

But what we can do is help the FCC in tiny ways get some legal leverage back on top of Ma Bell and, as we do this, what we can help the FCC do is articulate a vision that says – **why don't we just make all this big utility infrastructure and if we can do that, then what we can do is get some regulatory control and leverage back to people who really need it.** We want to get the states out of their hair because the Bells totally own the state commissions.

When you go before state commission, and you effectively get shot and then in each remaining commission get shot again, then there can not be a national network. You get the little niche

network but they are not big enough to stand up to a national predator and they get ground out of existence.

COOK Report: And if ATT and Verizon got the states to hand them control of all the cloud infrastructure, they'd be happy.

Cecil: Right. So the first thing we want to do is give the FCC the power to reduce these regulatory ploys by a factor of 50. It is a lot easier to have to fight it once in front of the FCC than to fight it here and have to go fight it 50 times again in front of each state PUC.

COOK Report: The amount of things you can do with devices attached to a network is not slowing down regardless of what you think of the state of the internet. The capability is speeding up. So how do you play under this state of affairs?

If you don't solve the wire-owner problem, the benefits from this state of affairs disappear. People have always said this but it has never been so clear exactly why.

Cecil: OK – well recall again that they way we regulate devices in the struggle for access to the wire.-- that the way we regulate this in the US, once at the national level and again at the state level no less than 50 times means

that the more often it is regulated the worse it is. The issue then is would you rather fight the device versus wire battle at the FCC, find out what the rules are once, and then deploy?

Or, would you like to get that direction, then go out and try to deploy only to find out there are 50 new answers to the question of what the rules are? This is why regulated competition didn't work. Once all of the Congressional cooks were done, once we finished mammoth proceedings in front of the FCC, once we survived multiple federal court battles, guess what? The states started to reinterpret federal law, again. Even after the states had appealed FCC Rules enabled under the federal Telecommunications Act of 1996, they didn't stop challenging, reinterpreting, and changing them. It is device versus wire all over again.

COOK Report And for any device maker the economic consequences of having to interrupt service or not get paid for service at the same time that it has to pay legal costs are huge. Might it be, given the economic peril we are in that, if that gets worse, the argument may have to be made that the only way to keep our society from fragmenting and collapsing is for the center in this case the FCC take prece-

dence?

Cecil: Yes. I think so. Let's get back to basics. What I am showing you is just simple legal truths -- now how we use these legal truths in different places is going to be different.

Common Carriage

To get back to your original question. If cloud computing makes it all into a utility, the best economics for cloud computing to succeed are the widest economies of scale. If you want this to succeed you cannot tell hardware for the cloud to operate differently in 50 different states. The cloud infrastructure will need a single set of standards. So when I say to the guys guiding the implementation – anchor it in fresh statutory bed rock – I don't really care how you do it. **But if you call all of it telecommunications in your statutes, then all of it is subject to common carriage. And if it is common carriage, because it is telecommunication, the FCC has jurisdiction to preempt state regulation because its inter state character is recognized.**

COOK Report: Ah hah. Nice move. I am seeing how moving everything to deregulated enhanced services in effect also moved any and all disputes down to the state level

– times 50.

Cecil: Yes!

COOK Report: Now how do you handle the spam argument?

Cecil: Don't confuse network management with law. You can build a legal defense for the ISP not to have to harm everyone else by making his own judgment about how he will deliver the best form of carriage.

If we call it all telecommunications can Spamford then claim common carriage as a protection for all he is doing? Absolutely not. I am delinking a legal right from application to a specific technology because **what we really need to do is to give whomever is doing stuff with edge devices a legal right that goes end to end.** *I want to give every bit in the cloud the legal right of common carriage without that legal right depending on the technology protocol used. I want to give them the legal right to do cool stuff with their technology without having to worry about losing the legal right if the technology is also pushed to do something else – like in his case spam.*

You see the whole Internet ESP thing is a technology specific exemption but it is

done by means of policy for that specific technology. Policy is not technology. Law is not technology. Technology is just technology.

That technology - in this case a protocol - appears to be law is the toxic unintended consequence of the FCC's original decision to exempt the Internet from regulation via the ESP exemption, which now means any transmission in Internet Protocol is not regulated. But even that statement is no longer true; VoIP is heavily regulated via dozens of FCC Orders, Rules and Policies, but is not afforded any protection that transmissions by other means, say Time Division Multiplexing, are accorded. As a result, VoIP has suffered heavily because a majority of the burdens placed upon old fashioned plain old telephone service already attach to VoIP. And, as I explained above, because we have abandoned competition, VoIP does not fare well at the state level when it comes to interconnection. Worse yet, any network providing VoIP, must replicate Bell costs and continue to pay Bell via all sorts of charges that Bell imposes upon (and state regulators approve) any network that connects with Bell that also transmits voice in IP format.

VoIP, therefore, demonstrates both the fact of regulatory capture - innovation cannot

compete with incumbent, but must rather replicate it; and the deeper dynamic that device owners and innovators end up subsidizing wireline. It teaches us, therefore, that we must de-link law from technology; we must limit as much as possible the ability of a wire owner to extract economic value from device owners (and any software providers).

COOK Report: The policy is about access to technology and the conditions under which it operates.

Cecil: Exactly. You see we don't have to stop at IP. Just call common carriage common carriage regardless of whether you use IP, or Frame or ATM to move the bits. Just imagine world where we have reduced the threat to any new technology we get those new technologies end to end interstate rights and doing so embeds the rights in statute.

Now you have to take the spam issue and the chances are you will wind up with a rule making which will do you no good for the same reason that treating network neutrality under any kind of rule making will fail. Why? Because a net neutrality complaint would say hey - ATT is using its facilities to screw round with my bits. So you have a rulemaking about bits.

But immediately you have an all important basic question. Are you going to call them bits or are you going to call them telecommunications. The second those bits change from IP to TDM- all of a sudden Ma Bell can impose a bunch of costs in front of the state PUC. Meanwhile, AT&T and Verizon can game costs they imposed upon bits in innumerable ways because they continue to own the landline facilities, impose giant costs there, and then shift traffic to other carriers or other networks, who, when they hit the incumbent landline, have to pay the subsidies.

The solution is for the FCC to call those net neutrality bits telecom and thereby exempt them from state regulation. Do that as a matter of statute and, when you are done, we can have a rule making, and in the rules you can say a network operating under common carriage must kill Spamdorf because any carrier is allowed to exercise reasonable control over its network.

This would be true whether the network rides TDM or IP, because even in a TDM world there are all sorts of standards for operation of a network. While the standards would be technically different for IP, they would still be rea-

sonable industry-approved standards. This is why it is so important to de-link law and technology. If we don't, we're confused into thinking common carriage would be the death of the Internet, when, in fact, it is the very lack of such rights that led to the Net Neutrality debate in the first place.

COOK Report: And if the bits in the cloud are common carriage we do assume that the wire owner who is in the business of transporting bits from one side of the cloud to the other has expenses to maintain and operate their infrastructure and must be paid a reasonable rate for operating that infrastructure. But we also assume that the wire owner becomes a transport specialist and income that it gets will be income for common bit carriage through a big pipe from one edge of the cloud to the other and nothing else. Right?

Cecil. Yes. But there is more. If end-to-end is interstate and if the FCC says it is common carriage, then anyone with a device that connects to the network gets the rights of common carriage. With my device attached to the net, I don't need the carrier to sell me any service other than a big symmetrical pipe.

Because guess what – if we go to cloud several things are

irrelevant. AT&T for starters: If I have an ATT Blackberry or I-phone and I want to put a cloud application on it and I want the app to run smoking hot. If I put my device and app on that network and they do anything to my bits that have common carriage rights they are in trouble.

COOK Report But how do I get access to the cloud?

Cecil: Remember that just because the law describes technology doesn't mean the law has to be specific to it. What I want you to have is legal rights to do stuff with your devices independent of whatever kind of network they ride on. And what cloud apps want to do is give you the ability to do all kinds of stuff with all kinds of devices independent of how those signals get to you because the networks don't care.

COOK Report: So a network owner would not be able to manipulate its network in a way that my device would not be able to connect to it because it would be violating its common carriage requirements?

Cecil: Yes and if we do it that way all we have is the FCC to worry about. and then the small guys have a much better chance and they can fight the battle on the national state with everyone

looking. That is a far safer place to be.

You don't want to be answering again and again and again questions in Texas, Oregon, Arkansas, Wyoming, or Missouri, for example, that were answered long ago in Washington D.C. State regulatory personnel will tell you that they get tired of being gamed by constant questions on these matters. In all fairness to state PUC staff, the lack of clarity from the FCC, over time, is extremely corrosive. They feel very caught between Bell on one hand and competition on the other. They also feel that they have no regulatory tools with which to address these market (and regulatory) failures that are now becoming so obvious.

By contrast, having a single set of simple, easy to understand laws and principles with clear direction from the FCC, even the smallest player has a chance because they won't be subject to 50 different interpretations of the same rule.

The Next Chapter

Editor - When I wrote this up I realized that Erik's prescript appeared to be that the FCC should just remove IP from the ESP exemption. Thinking about this I realized that I did not understand HOW it might

be done. Of course the next thing was to ask.

COOK Report: How do you get IP as a protocol removed from the ESP exemption and returned to "telecommunications"?

Could the FCC make this change on its own or would congress have to pass a law? Could the FCC FCC to say wait a minute the only solution to the problem with neutrality is not a clumsy rule-making but something embedded in statute and that we therefore rule (and ask Congress if it deems necessary to pass a statute agreeing) that the Internet protocol is to be treated as telecommunications under the earlier FCC computer findings. If IP bits are Telecommunications then telecommunications is also interstate traffic used in interstate commerce and therefore in the exclusive purview of the FCC in regulating communication among the states.

Marc Cooper: Just like the post office carries envelopes without opening them, the telecom network can carry bits without messing with them. The court in *Portland v. ATT* clearly understood this, but the morons at the FCC could not. It is hard to change your mind under the doctrine of *stare decisis* (which translates roughly as once you make a mistake you

have to keep making it until enough shit piles up that even a moron can see it was a mistake), but it can be done. You have to have a very strong reason to change your mind, especially in a short time. Of course, Congress can change its mind if it has the votes. The fact that one third of the Democrats in the House have written to the FCC telling it not to launch its network neutrality rulemaking suggests you might have some difficulty mustering a majority, especially since the Senate is more conservative and you need a super majority.

Chris Savage: Gordon,

I personally am not at all sure that I think it would be a good idea, but in an "Emperor has no clothes" mode, I find it sort of amusing that anyone things that reaching this conclusion in a reasoned way would be "hard" in any meaningful sense. So, as a purely conceptual exercise (a "Savage Thought Experiment," if you will), I would note the following:

1. Telecommunications is the transmission of user data between points designated by user with no change in form or content. [47 U.S.C. sec. 153(43).]

2. Communications via "the Internet" involve the formatting of user data into IP for-

mat, then transmission via various cool technologies, then delivery to another end point, also in IP format.

Therefore Internet transmission does not involve any net change in format. [Cite expert affidavits and technical documentation.]

3. Telecommunications "service" is offering "telecommunications" to the public for a fee, regardless of the facilities used. [47 U.S.C. sec. 153(47)].

4. The entities that most people would today recognize as providers of Internet access offer their services widely to the public and charge fees for those services. [Cite/discuss market facts. Also discuss *National Association of Regulatory Utility Commissioners v. FCC*, 525 F.2d 630 (D.C. Cir. 1976) and subsequent cases.]

5. Therefore, those entities are providers of telecommunications service. This makes them telecommunications "carriers" under Title II. Note, however, that they are only carriers with respect to the "carrier" things they do, and things that are reasonably ancillary/adjunct to it. [47 U.S.C. sec. 153(44) and associated FCC rulings re: "adjunct to basic."] So, the FCC would need to sort out which functions that Internet access/transmission entities perform that would still be

"information services."

6. The FCC would probably not want to impose the full range of Title II carrier obligations on Internet access providers. Therefore, it would want to use its authority under Section 10 of the Act to refrain from applying many normal "carrier" requirements to these entities. [47 U.S.C. sec. 160.] Tariffing, accounting requirements, Section 214 market entry/exit/transfer requirements, etc., are likely candidates for this "forbearance" under Section 10.

7. Because of its longstanding decisions to classify ISPs and broadband access providers as information services providers, the FCC would need to devote considerable attention to why it was changing its mind. To survive appeal the answer would have to be, probably:

(a) a VERY detailed factual analysis of what happens during IP transmission between (say) a consumer's home computer and a web site. This would have to go into much more depth than its previous decisions and, indeed, would ideally identify places where its previous decisions were factually wrong or incomplete. The point here would be to establish that ISPs really do offer end-to-end transmission of customer data without changing

it.

(b) an in-depth discussion of the changes in market structure surrounding Internet access as between (say) 1995-1996 and today, including a discussion of the widespread advertising and standardized characteristics of large ISPs offerings. The point here would be to establish that ISPs offer their services to the public on, generally, standard terms. (The leading case here remains *National Association of Regulatory Utility Commissioners v. FCC*, 525 F.2d 630 (D.C. Cir. 1976), noted above.)

I invite anyone else/everyone else to take shots at this. But I really do think it is this easy.

Anyone whose business plan depends on the status of providers of Internet access/transmission as "unregulated" and "non-carrier" is, in my view, whistling past the regulatory graveyard. Such a business plan is one FCC decision away from destruction.

COOK Report: to Erik Cecil - this seems discouragingly complex. Your reaction?

Smashing the Conventional Paradigm

Erik Cecil as the Hammer Thrower in the Apple ver-

sus IBM PC 1984 Super-bowl Commercial

Cecil: Congress put the Communications Act together to prevent monopoly. Instead it has become the most powerful and insidious tool of monopoly. It is a tool by which monopoly is preserved. **It gives to carriers and regulators powers that properly belong with individuals**, who, using today's technologies, can create, deploy and run networks vastly more powerful than anything ever conceived. By way of practical demonstration I work with a group who runs a *Fortune* 200 client's network nationwide using a couple of servers they bought off of ebay (it runs better than and at a fraction of the cost it would in other's hands - four 9s is the norm). Nothing in the Act even remotely contemplates such a world.

If anyone reading this takes one single thing from this now two-week long debate, watch what happens any time really flattening regulation is discussed. Those whose mini-monopolies always argue for the status quo, but watch the language. They always use the language of the status quo to justify and perpetuate the status quo.

Accordingly, it should come as no surprise that those who believe they may be threatened by a change to the

status quo rush to attack change using terms all of us know come from a past that is no longer relevant to creating an acceptable future, much less freeing us from the capture of loop plant that we suffer at present.

My detailed responses to Chris' points follow. (**Editor:** Savage in italics)

1. *Telecommunications is the transmission of user data between points designated by user with no change in form or content.* [47 U.S.C. sec. 153(43).]

2. *Communications via "the Internet" involve the formatting of user data into IP format, then transmission via various cool technologies, then delivery to another end point, also in IP format.*

Therefore Internet transmission does not involve any net change in format. [Cite expert affidavits and technical documentation.]

Cecil: Yes; 1 and 2 were technology-specific decisions that relative to the time and place of their original implementation were extremely necessary, wise and did good things; long story short, they protected the Internet (and it's now near-infinite array of devices / services) from predation by wire owners.

3. *Telecommunications "service" is offering "tele-*

communications" to the public for a fee, regardless of the facilities used. [47 U.S.C. sec. 153(47)].

Cecil: Indeed. **Note, however, that neither the statute nor the FCC ever clearly defines "facilities" or "services"**. Worse yet, 90% of the legal battles crippling the underlying networks (Google's inexpensive backbone notwithstanding, but note there's only so far Google can go - they will never attempt to touch the edge with their ultra low cost backbone because of regulation, not because of technology) are about these and even older non-defined terms like "interexchange". Net Neutrality ensures that all this, uh, "regulation" stays in place.

4. *The entities that most people would today recognize as providers of Internet access offer their services widely to the public and charge fees for those services.* [Cite/discuss market facts. Also discuss *National Association of Regulatory Utility Commissioners v. FCC*, 525 F.2d 630 (D.C. Cir. 1976) and subsequent cases.]

Cecil: Unfortunately, neither all of the King's men nor all the King's horses could keep Humpty Dumpy from putting the monopoly back together again. We missed something

pretty darn big if statues enacted to prevent monopoly can, in a very short amount of time, be so easily manipulated to re-create the unthinkable: edge monopoly + a world where we think that paying MORE to edge monopoly is somehow a solution. Perhaps that's fine for Google, what do they care? It doesn't come out of their pocket; real people pay more for connectivity to get to Google. But that doesn't mean dinging Google for more cash makes any sense either.

Long story short, if your freakin network is expensive, run it more cheaply. Make a better solution, but don't force consumers to pay more for a lousy loop systems that operators have been milking for 40+ years. (See Mark Cooper's points above about politicians making bad choices; compare that to his views of the Portland Case, which the FCC decided for political and market reasons not legal ones. Had Portland had it's way, cable costs would have skyrocketed by many multiples. Somehow that doesn't enter into Mark's thinking.)

5. *Therefore, those entities are providers of telecommunications service. This makes them telecommunications "carriers" under Title II.*

Note, however, that they are

only carriers with respect to the "carrier" things they do, and things that are reasonably ancillary/adjunct to it. [47 U.S.C. sec. 153(44) and associated FCC rulings re: "adjunct to basic."] So, the FCC would need to sort out which functions that Internet access/transmission entities perform that would still be "information services."

Cecil: Herein lies our biggest mistake. **We equated "carrier" + "regulation" as being in the public interest. It wasn't. Regulators primarily serve carriers, not the public. That's the biggest problem of all. It must be fixed. We must put the real public back in "public interest".** (Note again the trade press reporting about Net Neutrality. As of the date of publication, the FCC is already watering down the requirements under pressure from Congress and under its own internal political pressure. These rules will make zero sense by the time they see the light of day; we haven't even yet started the comment rounds.)

6. *The FCC would probably not want to impose the full range of Title II carrier obligations on Internet access providers.*

Cecil: As a broad policy-based generalization, that may be correct. But when one observes the basis of

market power in this country, clearly, no entity can have any reasonable chance of providing service if it cannot provide voice services at compelling levels of quality and price.

At present such combinations are impossible for two basic reasons: (a) IP voice is subject to almost complete common carriage regulation - from CALEA, to CPNI requirements, to 911, and contributing to USF; while (b) being afforded very few of Title II's privileges or rights - whether in terms of rate and liability protection afforded via filed rate doctrine or fuller rights of carriage and interconnection only marginally afforded under FCC "interpretations" of the rules.

Therefore, it would want to use its authority under Section 10 of the Act to refrain from applying many normal "carrier" requirements to these entities. [47 U.S.C. sec. 160.] Tariffing, accounting requirements, Section 214 market entry/exit/transfer requirements, etc., are likely candidates for this "forbearance" under Section 10.

Cecil: On this point agreed. But before this happens, the FCC must declare the service to be interstate. As to Section 10, they should apply Section 10 only to the exact same extent as they'd apply

it to other services, including interstate TDM in every form.

That's a whole other discussion, and watch as those who argue "I get to charge as much for my expensive bits as I like b/c I have real costs" go purple screaming about how Ma's costs are too much.

For the most part, those screaming themselves are purple are correct. At the same time, however, the real cancer is a world where regulator and carrier determine what is in the public interest, which, in a world where the public has access to technology that makes the concepts of "cable" or "telephone" or "wireless" service anachronistic, artificial and very expensive to the point of constraining innovation and precluding deployment of less expensive more capable technologies, well, you tell me: sane or insane? Wise use of money or just spending OPM (Other People's Money)? (Note Harold Feld's frustrations: 5 FCC Commissioners (politicians) + Big Cable + Big Telco are making the final decisions about Net Neutrality; somehow Media Access Project, and I suspect many others feel left out. But how can anyone explain Net Neutrality? How can there be any political consensus on it at all? No one knows what it means.)

7. *Because of its longstand-*

ing decisions to classify ISPs and broadband access providers as information services providers, the FCC would need to devote considerable attention to why it was changing its mind.

To survive appeal the answer would have to be, probably:

(a) a VERY detailed factual analysis of what happens during IP transmission between (say) a consumer's home computer and a web site.

This would have to go into much more depth than its previous decisions and, indeed, would ideally identify places where its previous decisions were factually wrong or incomplete. The point here would be to establish that ISPs really do offer end-to-end transmission of customer data without changing it.

Cecil: Well, yes and no. Within the context of redoing the existing machine, they have to answer those questions. At the same time, they have to reassert why it is they must abandon what once served the entire public no longer actually serves the public. IN other words, the FCC has to own up to how badly they've screwed the pooch.

Look, this could be easy or impossibly hard. It all comes

down to framing. IF we want to just chain ourselves to the past failed models, we can.

We can argue till we die about ISP, Carrier, loop, middle, backbone, etc. No 100,000,0000 twists of that Rubik's Cube will ever move us into a world of ubiquitous commodity connectivity, cloud utilities, and services that make economic and technological sense. Paying for bits just extracts more money out of consumer pockets to subsidize an already lousy and failed system.

The only things relevant to the PUBLIC interest (as opposed to CARRIER interest) is the Public's freedom to use, create, manipulate, etc. devices and intelligence between and among themselves.

The PUBLIC IS carrier-agnostic, THE PUBLIC IS loop-agnostic (as demonstrated by the fact that landline service sucks in every respect; it doesn't have to but it does), THE PUBLIC IS, increasingly, device agnostic (is iPhone really a device or a platform for selling software?), and THE PUBLIC IS, increasingly, content-agnostic. (The second sufficient fiber optic hits a sufficient number of edges, there's not a regulated model out there that's relevant).

The PUBLIC is also politically agnostic. It takes time, but they can and will boot political regimes out of DC. I don't take as a given the Democrats are around for the next 30 years. If the Democrats do not learn how to empower the post-PC generation in ways that matter, they are simply marching towards political extinction. **The moment the right wing (or just independently minded people) understand that for the younger generations computers are infinitely more powerful than guns, they'll try to amend the constitution to include permanent inalienable rights of access because in a post-nuclear world guns are the first trip down a short path to annihilation.**

Information technologies, however, transform geopolitics. Bullets move flesh; pens move entire political systems; they transform minds; economies are made up of thoughts, nothing more. Move minds, you literally move mountains.

Who, therefore, should be in control? Carriers & the regulators carriers depend upon to slice up the scarcity pie or the public? What's transparent - you control your own network, you have legal rights at least as powerful as the technology you use and at least as broad as the audience you can reach OR you

just continue to rely on AT&T, Verizon, and their 20 largest customers (uh, the rest of the market), plus the FCC + 50 state "public" utility commissions to run this? Tell me how many of these FCC commissioners have actually built, run or litigated a network related issue?

We're crowd sourcing the Internet to the people whose vested interests lie in maintaining the status quo. The Internet does not belong to the Portals, it does not belong to the Democrats (or Republicans), it does not belong to AT&T, Verizon, Google, Comcast or anyone. If you are in the middle, you are in the way. Do something about that. Transform yourself into getting out of the way, empowering individual people and creating economic productivity rather than hoarding monetary and political control in the middle.

The public Internet belongs to the public, not the regulators and not the industry. The only thing the public needs is to talk to the rest of the public. Fat middles are toxic not only to humans, but also to networks and economies. It's time to put the fat regulatory and fat carrier middle on a crash diet. The rest of us are starving.

(b) an in-depth discussion of the changes in market structure surrounding Inter-

net access as between (say) 1995-1996 and today, including a discussion of the widespread advertising and standardized characteristics of large ISPs offerings. The point here would be to establish that ISPs offer their services to the public on, generally, standard terms. (The leading case here remains National Association of Regulatory Utility Commissioners v. FCC, 525 F.2d 630 (D.C. Cir. 1976), noted above.)

Cecil: What they need to recognize is that by remaining tied to Bell's model of extracting value from devices via ownership of the wire are the limits of that model.

There are three basic limits to conditions to the model of wire owner extracting money from device user:

(a) PRECLUDES COMPETITION: no wire owner (other than Verizon/ATT) can serve new end users because monopoly conditions brought about by the model simultaneously prevents them from entering new markets as network access costs are prohibitive (in other words, if wire owner can extract value from consumer, wire owner can also extract value from other wire / network owners);

(b) PREDATORY ECONOMICS

ARE SHORT LIVED : there's only so much money monopoly wire owners can take from captured end users (and now far less as a result of the recession);

(c) PREDATORY TECHNOLOGIES CREATE VALUE-LESS VERTICAL MONOPOLIES: the limited amount of money wire owners can extract from their captured end users is relative to two basic things: (x) end user perception of value of the service wire owner provides (is it unique, high intelligence, solve things that other services do not solve, etc.); and (y) end users' ability to create economic value using wire owner service as an input (which is basically zero for reasons implied above).

I invite anyone else/everyone else to take shots at this. But I really do think it is this easy.

Cecil: I agree that this is easy. And to tell you the truth, it is far easier than what will come out of the Net Neutrality sausage mill. The more the FCC talks about justifying that mess, the more they expose themselves to appeal. The less they talk about it, the more obvious it will be that it must be overturned on appeal. Either way, it is appealed. Either way it's a battle and a mess. The only question is whether the FCC is going to waste our

time and money fighting over creampuff "Neutrality" filling or whether they've got the backbone to serve end user customers the proteins, vegetables, and fruits of ubiquitous connectivity the PEOPLE of this nation so richly deserve.

Anyone whose business plan depends on the status of providers of Internet access/transmission as "unregulated" and "non-carrier" is, in my view, whistling past the regulatory graveyard. Such a business plan is one FCC decision away from destruction.

Cecil: If this were not true, there would be no need for regulated carriers to pump millions and millions of dollars into Astroturf., lobbyist, politician, etc. There'd be no need for them to blanket DC with endless and misleading advertisements every time some key piece of legislation might affect their perceived entitlement to keep their snouts in money troughs filled by emptying everyone's wallets.

We live in an age of commodity fiber optic transport providing connectivity never dreamed possible only 20 years ago. Computing is also a commodity input. Both put

into the hands of individuals the computing, processing, broadcasting, information gathering, content-generating and interactive power in ways unimaginable even 10 years ago.

We, the People, are capable of providing utility-like services anywhere connectivity exists.

We, the People, must have legal rights in our hands at least as powerful as the technologies we carry around in our pockets.

We, the People, must be free to deploy our technology on our terms; we cannot be required to subsidize wire owners who extract value from our minds, our rights of way, and our wallets in order that they may continue to sell back to us fractions of the capabilities technology has already commoditized.

We, the People, must be free to reject as irrelevant politicians who spend hundreds of millions of dollars of tax payer money to create and adjudicate carrier's rules for apportioning technological scarcities and selling it back to us.

We, the People, are the Public Utilities; we are the Public Interest; it is our

government, and it is our Internet.

There are no competitors and there's barely an Internet left outside of the branded Mall of America that the FCC is apparently about to convince us is the cutting edge.

I think America, however, has had enough of the cutting edge; it hurts because it is so dull and it bleeds because it is so inefficient. They can do far better themselves. DC needs to push monopolies out of the way, step out of the middle itself and get behind people instead of on top of them.

Ken Miller: If the IP service was a power utility: Would it be permissible to drop the top 1000 subscribers monthly because they consume too much? Would capping the power consumption at a residence be acceptable? Any incentives for consumers to peak shave their bandwidth use? e.g. Download the movie all day (lower \$/Mb) instead of expect it on demand (High \$/Mb)? The power utility has all the capacity built into the local distribution network with far greater physics limitations, why can't the fiber/bandwidth providers? The power utility has all the reserve capacity costs built into their rates, why can't the bandwidth pro-

viders?

I am struggling with the cost issue a little. My electric bill is less than my bandwidth bill and I know they have Trillions invested and deliver for all but the peak demands? Why can't bandwidth providers?

I can buy 100Mb/s or even 1Gbps links between cities for very reasonable costs \$10-30k/mo (very different from the old DS3 days). What kind of bandwidth does a provider like Comcast see at their head end that is unreasonable to too much? Y Subscribers yields XXXGps. Is that ratio so out of whack with the back end costs OR.... is this more an argument by the bandwidth providers that they would have to give up the very large margins?

Cecil: You are struggling because of the gross and insane contradictions caused by a fractured and compartmentalized regulatory system imposed over networks and technologies that have long since rendered the law and subsidies irrelevant to anything the public values. A case in point as illustrated in this very discussion thread:

1. An entity known to dislike paying 95th percentile, but convinced of the cost savings possible with fiber optic, fires

its carriers according to Wired Magazine and builds and operates an optical backbone resulting in near zero cost per bit. www.wired.com/epicenter/2009/10/youtube-bandwidth/ From a public policy perspective, this is a good thing because it reduces costs of providing services to everyone.

2. Our regulatory system however, encourages this company to agree to and perhaps even quietly acquiesce to allowing regulators to use other parts of our compartmentalized regulatory system to basically charge consumers more money for loops that they've already paid for. Apparently they might lessen the shock of that if they more or less advocate for 95th percentile billing. This is something that when the company itself is faced with mounting telecom costs it finds unacceptable, but seeing no other way to navigate an upside down and backward regulatory system, apparently has to get along to play along. What's good for the backbone goose, however, is a cooking pot for the loop gander.

3. Not discussed here because our compartmentalized system prevents us from seeing the system as a whole, is that, when certain entities offer voice services, they can simply hire others to do it for them. The beauty of this is

that other entities - primarily competitive carriers - bear the risk and expense of per minute subsidies paid to carriers who own loops.

Odlyzko: This whole discussion is premised on the assumption that demand exceeds supply, reminiscent of the claims I have heard for a couple of decades, about "insatiable demand for bandwidth," etc. Now in wireline, that has not held for quite a long time, and does not hold right now. Utilizations have been low, and have been decreasing. A typical residential broadband customer runs the download side of his or her connection at about 1-3% average utilization (over a full week, say). So even if all these downloads came from P2P systems, the upload utilizations (if spread evenly among all users) would only produce 5-15% average utilizations (assuming download speeds are 5x those of uplinks). That's why P2P systems, starting with Napster, have consistently disappointed the doomsayers by not bringing the Net down. The traffic has simply not been that high.

Now there are all sorts of caveats, of course. Things could change. (But then an asteroid could wipe us all out tomorrow, too.) And global averages do not say much about what happens locally. And if you happen to have a

1 Gbps symmetric link, P2P systems will use your computer preferentially as a source, so you could easily get congestion. But overall, P2P has not been that much of a problem, and it is actually decreasing as a fraction of total traffic.

A final remark: These comments apply just to wireline. In wireless, the situation is different, demand is pressing against, and may soon exceed supply, and so the optimal business plans, architectures, ..., may well turn out to be different.

Cecil: I may disagree that the discussions assume demand exceeds supply, or insofar as my views are concerned, that is not my thesis at all. **Rather my thesis is that supply is artificially expensive and artificially constrained resulting in deadweight economic loss.** My regulatory case is that consumers are forced to fund a system that is invested in disabling technology. The simple case is exemplified by the use of technology in backbone architectures as contrasted with loop.

Note that this approach is willing to examine actual costs of deploying physical loop plant, but not on bell-centric or traditional (and mostly ancient) regulatory formulations that see as anathema the idea that carri-

ers per se are no longer relevant, or that single national regulatory frameworks are more efficient than the balkanized systems we endure today. Those assumptions have no independent validity; they were merely a framework under which we have become accustomed to operating. So long as actual in the ground deployment costs are observed relative to outputs as well as relative to a system that promotes rather than discourages such approaches, then fair(er) comparisons can be made.

Accordingly, neither "supply" nor "demand" drive this approach so much as examination of what I see is pure dead weight economic loss as well as the corresponding loss of opportunity. [**Editor: Note that in the next issue - January 2010 we will introduce Tim Cowen and his work on this subject - having connected Tim and Erik.**] But so long as the inputs to connectivity remain artificially expensive, the entire system is funding technologies and business models that are already obsolete. I see Tim Cowen's work on the enormous savings resulting from Cloud Computing Utilities, Lee Selwyn's work demonstrating the shrinking natural monopoly, Carolotta Perez's formulations about cycles of innovation, and lots of experiential evidence including but not limited to experts I've

worked with on economic, business, and network issues, as supporting this as true.

COOK Report: So what precisely do we have to do to test and overturn this?

Cecil: Gordon, I've laid this out 1000 times.

1. Simplify regulation. One network, one law. It has to be federal.

Goldsetin: I'll second that.

Networks today are much less localized than before, even compared to TA96. Federal/state mixed jurisdiction over telecom is obsolete. It dates back to the era when telephony was almost entirely local, with Long Distance a rare luxury. Jurisdictional separations, though, is totally broken, and so is the system where states and feds fight over rules. Let the feds own it, even if certain rates, to the extent that they need to reflect local costs, can be set with state input.

And even there I'm getting worried. ATT recently got a couple of states to flagrantly flout TA96 and abolish TELRIC-based UNE rates for interoffice (middle mile) facilities. What was <\$1/month for a DS1 mile is now >\$16/month in Arkansas, for instance. The state didn't do what TA96 told it to do. But who's left to sue? The little

guys are put out of business but can't afford the federal litigation.

Cecil: 2. Make regulation transparent. See above.

3. Enable technology. Networks are not technology; they are inputs.

4. Do not enable politicians. They cannot be trusted over the long term. Enable everyone.

5. Have Courage. Nothing but failure is assured if we stand still, proceed forward on yesterday's terms, or capitulate.

Serve the individual, not the corporation and not the regulator. Public interest is public interest.

Goldstein: All good points.

COOK Report: The exchange with Chris indicates that in theory IP could be classified as telecommunications. That would help. How to start such a ball rolling?

Cecil: 1. Sue Bell.

2. Sue the FCC. Net Neutrality will be appealed. If someone does not set this up in Comments to the FCC in the relevant proceedings there is less of a chance of meaningful change. There will be a shootout at the DC Circuit. Those who are posi-

tioned in advance will win. Consumers, however, will most likely lose.

3. Hold the administration's feet to the fire. Do not believe anything anyone says until you see it implemented. The road to 2009 was paved with good intentions and things said behind closed doors. If they cannot say it and embrace it in the open, it is not real.

Who Will Be the New Theodore Vail? -- Google?

Atkinson: Cable and telcos have been able to "divide the market" during the growth phase of broadband because there were enough customers for both. But overall broadband adoption has slowed considerably and is likely to drop to 1-2% in the next few years. At that point, the duopolists can only grow by taking customers from each other and with their incremental costs of doing so very low, the potential of price wars and similar attributes of intense competition become possible and even likely. Of course, aggressive competition is likely to lead to the demise of one of the duopolists or the other in any given geographic market and then the survivor will be regulated because an unregulated monopoly of a vital service is unacceptable.

It is somewhat like the history of the "narrowband" (aka, telephone) business a hundred years ago: **who will be the new Theodore Vail getting a legal monopoly and antitrust immunity for rate of return regulation of a gold-plated infrastructure? Promises of a gigabit to every home...**

Tim Cowen: Forgive me but since you have thrown down the gauntlet shouldn't Google pick it up?

Deal for the customers: free telephony, free broadband, non discriminatory access to the world's knowledge in return for rate of return regulation.....(And the freedom to make money out of ad streams as well).

All that is needed is to submit to being a regulated utility, allow the consequences to undermine the value of the competition, buy the underlying communications infrastructure for a song (but safeguard the pension rights to ensure political credibility). . .manage congestion and secure free speech...

Where's the downside?

Harold Feld: When we talk about Google as the new monopoly. It is helpful to be precise about things like market

definition and its impact on the current debate.

I cannot confess to be a Google expert, but from where I sit:

Google owns no actual residential service facilities.

Google owns a fair amount of fiber, primarily for its own use.

Google provides certain sorts of applications and software which, in the delightful way these technologies work, tend to work together and reinforce each other in terms of "stickiness" and market dominance.

Many of Google's markets are hidden from view and difficult to assess. For example, I have no idea how their online advertising works except for the few widgets I actually see. The numerous revenue streams coming into the company from a variety of areas is huge.

At the moment, it would appear to me that Google has dominance in a few related fields. Search is the big one, then comes online advertising. Not sure about others.

A critical question, however, is how easy or hard is it to break into this market and actually take business away from Google (i.e., is the market(s) "contestable") and what impact on the existing

market does dominance have. This is where it always gets tricky under antitrust law. The ability to influence a market -- including in an anticompetitive way -- is not always a function of size or even size delimited by geography.

A critical player with a small market size can exert unusually large influence depending on industry structure. Similarly, a dominant player may have little ability to exert market power because the market is so contestable. AOL, at the height of its power, was never able to exact more than 2 dollars above the average dial up ISP price, because it was too easy to switch to one of too many competitors at that time. By contrast, in *Federal Trade Commission v. Toys-R-us*, the FTC found (and the court affirmed) that Toys-R-us' role as a critical buyer gave it power over the wholesale market, despite having only 22% of the retail market.

Google is big, no question. It is also big in ways I can't see, which makes me nervous. It is big in ways that appear likely to be self-reinforcing, particularly in the area of online advertising. But from this alone I cannot tell if it is a "monopoly" or even a dominant player exercising market power. -- or even what the relevant markets are. I yield the floor, however, to the

growing field of Googleologists in the various antitrust divisions of various governments who have better access to the information.

COOK REPORT: Well said Harold. But are there two markets? The one you are talking about is the online advertising market - in which by virtue of the things that gGoogle has done it has a huge commanding lead. However is there not another market of physical infrastructure? IE dark fiber.

Look at:

Cecil: Bell downside? Google is the new monopoly and bells are the new deregulated kids on the block. Look, my computer doesn't care whose loop it is or whose servers I hit. There's my computer and there's the world. Everything in-between is part of the network. So regulate intelligence - that's where the money is, isn't it? Deregulate the stupid pipes b/c who needs to protect pipes? Who cares? If they are valuable enough, then someone making money will build them - heck, I think Google just built their own backbone didn't they? Ya know, of the two, I'd far rather have Google as Ma Bell than Ma as Ma Bell. Time to set her free and usher in the new era. Ma Bell is now "G". I'm cool with that. [snip]

COOK Report: it sounds to me like *Wired Magazine's* article might indicate that Google's dark fiber net is comparable to Ma Bell's in size. If so, doesn't that give Google very interesting leverage in its interconnection and traffic handling with "Ma" Bell as the bridge from the Google network to Google's customers? Could it be that Google not only has the huge pipes but the content and applications that we all want? And is "Ma" stuck with what?.... the dumb pipes of the last mile and not much else. And all this stuff is unregulated and carried out in the dark.

QUESTION - From a policy point of view is not transparency better than what we have now? And therefore since all of telecom -- at least the telecom that counts -- runs on IP, would not the public interest be hugely served by ending the ESP exemption for IP and declaring that all internet bits are telecom bits and subject to more scrutiny than they are at present? Do this and it would likely bring into day light the size of Google's infrastructure. Where is the harm in doing that?

Cecil: Mostly I'm poking fun at the fact that when it comes to law and regulation we are all thumbs regulating new world mammals with tools deigned for cold blooded dinosaurs. It is so

convoluted that one could, as AT&T has, try to paint Google as the monopolist.

Regarding dark fiber networks, ***the real point there is not so much that Google has one as it is that there is NO LOOP and NO BACKBONE. There is just network. Where consumers and individuals are getting screwed badly is that we continue to fund loop providers NOT to DEPLOY advanced equipment - wide open fiber optic.***

Google, Verizon, anyone with any technological or economic sense, however, does deploy it any time they can. There's a reason. It's low cost, provides incredibly cost effective connectivity and is reliable and has low OpEx. Nevertheless, regulation continues to penalize networks because, at a fundamental level, regulation has it backwards. No one gives a damn about loops, IXC, local, long distance or anything else. They just want connectivity and they want lots of it. What they will gladly pay incredible amounts of money for are devices and software that do useful, interesting, or entertaining things with all of this commodity connectivity and commodity computing power.

This is why Seidenberg said in a *WSJ* article on Sept. 17th that owning loops or lines is

over with. That's not Verizon's business. They want to be in Google's business - that business is doing cool stuff with software, connectivity and devices. The only thing that stands between a robustly competitive Internet fueled by fiber optic connectivity (or at a minimum where the incentives are directed toward increasing rather than constraining capacity) is our backward regulatory system!

THAT'S THE BIG POINT. So, of course, IP = Telecom helps that quite a bit as it simplifies the picture. And, if, indeed, Google thinks that consumers should pay more for loops they've already paid for by virtue of going along with a rationale that says bits are expensive, then let's shine a strong light on what everyone, Google, Verizon, AT&T are really doing in all of their network plant to get an idea of real costs. At the same time, this levels the playing field for consumers and device and software owners. It gives them a say they don't have today in what all of this network should cost.

John Waclawsky Nothing is wrong with making money but my judgment about company behavior revolve around two perspectives:

- 1) Do they produce end-user value?
- 2) Do they drive innovation

and new business models?

Do some companies do the opposite of 1) or 2) or both. Put a chart together to compare behavior. You will need some crisp definitions of "end-user value" such as does the end user get more for his money or even something for nothing or for looking at ads. Innovation means the fruition of an idea in the marketplace as a successful new product and/or service etc. It seems to me the existing monopolists are not exactly driving a lot of innovation outside the physical layer and they seem to consistently produce control oriented technology that fails. Maybe you need another item to the list 3) Do they waste money? :-)

Cooper: Generally, in anti-trust, i.e. the merger guidelines, a firm with a 65% market share is said to have market (or monopoly) power. One can invoke other market characteristics to argue that it does not (e.g. ease of entry, ability of competitors to expand supply, ease of switching). Because of these characteristics it might not be able to abuse its market power, even though the statistical analysis of market shares indicates that it has it.

In America, it is not illegal to win a monopoly by winning market share in a fair fight in

the marketplace. It is not illegal to be given a monopoly (e.g. the utility franchise). It is illegal to acquire a monopoly through merger (Dish-Echostar merger) or other anticompetitive contrivances (predatory pricing, Microsoft in the browser market). It is illegal to use the power of the monopoly to preserve it (Microsoft in the operating system market). It is illegal to abuse market power (the AT&T case, the really interesting case where the anti-trust laws are used against a franchise monopoly, Otter Tail in the electricity industry is similar)

Google probably has market power in the search market. So what? Unless you can show it obtained that market power illegally (no way) or until you can show it is abusing that market power (above all to preserve it, but also to harm consumers), it has done nothing wrong. In fact, Google may have the best ten year record of consumer-friendly innovation in history. Google enjoys Schumpeterian (innovator) rents and they have used those rents to continue to innovate. Since they have not done anything wrong, their claim that they lack market power is plausible. There is always the tendency for Schumpeterian rents to be transformed into Rockefeller rents, but it hasn't happened yet in the case of

Google.

Google's competitors (e.g. Microsoft) complain bitterly, but they have little credibility. Google invented effective search first and they have innovated around it dynamically to fend off dozens of competitors.

The suppliers of complementary services (telecoms) are envious and want to tax some of the innovation rents. Google's innovation increase the value of communications (search makes the broadband Internet space vastly more valuable because it renders the huge mass of information available in cyberspace vastly more usable). The network operators look at the innovation rents and demand a larger share of the value, even though they have done nothing to earn it. The only reason they could get away with the hold-up is that they do not face sufficient competition in communications services. If there were effective competition in communications services, it would compete prices down to cost of communications plus normal profits, which do not include Schumpeterian or Rockefeller rents. You have to earn Schumpeterian rents and Rockefeller rents are illegal.

Tim Cowen This may all be accurate, but the question wasn't whether there is or is not a monopoly. The question was whether a player who would do what Thomas Vail did for AT+T and do a deal with the federal government in return for a monopoly: and what would that deal be?

I suggested yesterday the following:

"Forgive me but since you have thrown down the gauntlet shouldn't Google pick it up? Deal for the customers: free telephony, free broadband, non discriminatory access to the world's knowledge in return for rate of return regulation.....(And the freedom to make money out of ad streams as well).

All that is needed is to submit to being a regulated utility, allow the consequences to undermine the value of the competition, buy the underlying communications infrastructure for a song (but safeguard the pension rights to ensure political credibility). . .manage congestion and secure free speech...

Where's the downside?

Paul Budde: Most monopolies don't start off as ugly monopolies.

From all records AT&T was a great, responsible and re-

spective company for most of its life, Microsoft started off as a great company and this is where Google is now.

History unfortunately has it that these companies have the potential to grow into those ugly formats and that's when they become a problem. We don't just have ugly dominant telcos, we see them in finance, energy, etc.

I sincerely hope that we as a society use the financial and environmental crises to address these problems and create the step change needed to rid ourselves of the ugly side of this phenomenon. If we don't they linger on as real pests in our society

Marc Cooper: I disagree on the history, but agree on the need to use the current crisis to change the policy frame. Since I work on financial services, I can assure you that the prospects are not great in that space, which means they are not great anywhere. The history of Microsoft does not support the claim that it was a great company for long. By 1990 it was engaging in all manner of anti-competitive practices to secure its monopoly. the operating system has been crap since then and the price has been too high (a good case can be made that the underlying software was essentially stolen. IBM felt compelled to renegotiate the

original agreement.) In AT&T's case the refusal to serve small town America and the interconnect with systems that were built after the patent expires is pretty nefarious..

Cecil: I agree completely with Mark that "The suppliers of complementary services (telecoms) are envious and want to tax some of the innovation rents. Google's innovation increase the value of communications (search makes the broadband Internet space vastly more valuable because it renders the huge mass of information available in cyberspace vastly more usable)."

Where I disagree is the thought that more competition is going to make a difference. How can you even begin to define competition where AT&T and Verizon each own loop networks, backhaul, content (i.e. cable television model), wireless, long-distance, Internet backbone, and enterprise networks?

At the same time, every carrier, search engine (if you think that's all that Google does), and any entity of any size is transitioning to fiber optic backbones –waves, IP, etc.

Against these two trends we imagine that funding another

loop matters? It doesn't, not in any bottom line sense.

Google is not the new monopoly. What is unclear outside of carrier space is that Google is the new competition. They are moving strongly into enterprise services, which is the cream of the carrier revenue stream. They are moving strongly into content, again, that's a valuable market. They provide software platforms that run on wireless networks. They are everywhere. That's the point. That's what Verizon, BT, and every other carrier out there is saying. If you've been reading Gordon's

interviews, this would be obvious. And they are right. Convergence is here.

As much as I agree with Mark's basic points, however, if we run this game with Ma's economics, we'll get Ma's results. If we divide the world up into all of these compartmentalized "markets", all of which roll up to the same bottom lines - whether for AT&T, Google, Verizon or T-mobile or Sprint - we will continue to see inconsistent results.

The problem, ultimately is not lack of regulation but asymmetrical regulation. IT

is applied unevenly and so far, it unevenly favors Bellco. So, let's take Bellco at their word and quit subsidizing their view of the world. Let's give some to Google, to T-mobile, to Cable and everyone else. Let's prioritize subsidizing fiber optic infrastructure or loopco or both; let's deem anything on any network anywhere to be subject to full telecom regulation, and then exempt clearly only that which needs to be exempted.

Canopy Wireless - Kathmandu to Everest

Entrepreneurial Skill on Verge of Bringing Affordable Internet to Sherpas as well as Trekkers

Editor's Introduction

I have known Pavan Shakya since November 2002 when he introduced himself and Tsering Galtsyn Sherpa at the Kathmandu guest House. Pavan participated in the establishment of the cyber cafe at Everest base camp in the march through may period of 2003 and went with Tsering and Dave Hughes to instal a wireless cloud at Namche Bazar in October 2003.

COOK Report: Could we get started with a bit of biography? I understand that Dilleep, the CEO of World Link and you have been friends since you were in high school together. But where did your exposure to computers come from?

Shakya: I started using early microcomputers in grade 9. I think it was in 1988. I had access to a machine thanks to my uncle who is a graduate of Stanford University and who was a pioneer in developing the fonts for representing the Nepali language on a computer screen. I gained my first hands-on experience with WordStar 2.0 on a machine with no hard drive and a 5 inch floppy

disk.

In the early 1990s I was working with a company where i could use email. The email service was offered by Mercantile which was the first to offer some limited e-mail services in Nepal using software similar to the USENET the UUCP software popular in the United States during the

1980s. When Dilleep started WorldLink in 1996 as an Internet service provider, I took my e-mail experience to work for him.

COOK Report: What made the light go on in your mind about the importance of extending Internet service into rural areas in Nepal?



Pavan Shakya and Pemba Sherpa have teamed up to connect all of the Solu Khumbu



Top left - the new lodge on Khongde where in the summer of 2006 Pavan placed a relay radio with line of sight to most of the villages between Namche and Everest.



Radio Relay from Everest View to Kongde and from here 24 kilometers to Chukung

Pavan hopes to bring service to these villages in 2010. The dish on the left receives its signal from the canopy B20 shown on page 33 below.

Left - Looking Northward from the Kongde lodge to from left to right the summit of ever-est with plum of cloud blowing off top and Chukkung where a repeater receives a signal from web cam view of dangerously growing glacial lake.

Shakya : Back in 1996 communication in the urban areas was not that reliable and, often in the rural areas, it was absolutely unavailable.

But it was probably only in 2000 or 2001 that I started really seriously thinking about taking ISP connectivity into the rural areas while I was still working with WorldLink.

COOK Report: What inspired this?

Shakya. My grandparents are from the rural areas I learned from first-hand experience by observing the difficulties they encountered the burdens



Photo taken at Kongde

View from Kongde shows Syangboche airstrip, Everest View Hotel, Namche and army base. Note that the color of the earth should be green.

that the lack of reliable communications placed on people in the rural areas of Nepal. Only way to communicate was to go somewhere on foot or to send a letter to the destination you wished to reach.

In the Late 1990s when the Maoist insurgency became very severe what rural communications had been built were often destroyed. Beginning in 2000 I began to seriously search for ways in which the introduction of Internet could replace what had been destroyed and then expand communications in rural Nepal beyond that. I was motivated at this time it by my personal knowledge of the difficult experience of friends and relatives living in these areas.

COOK Report: Where did you get your first experience with wireless?

Shakya: My first experience in wireless was with World-Link. We needed to figure out any paths around Nepal telecom that we could manage to create. The experience with Dave Hughes and the Everest base camp project in early 2003 was helpful, but I had already gained a little bit of experience before that. We only really started using Canopy radios seriously in about 2004. At this point in time we started using Canopy radios inside of the greater



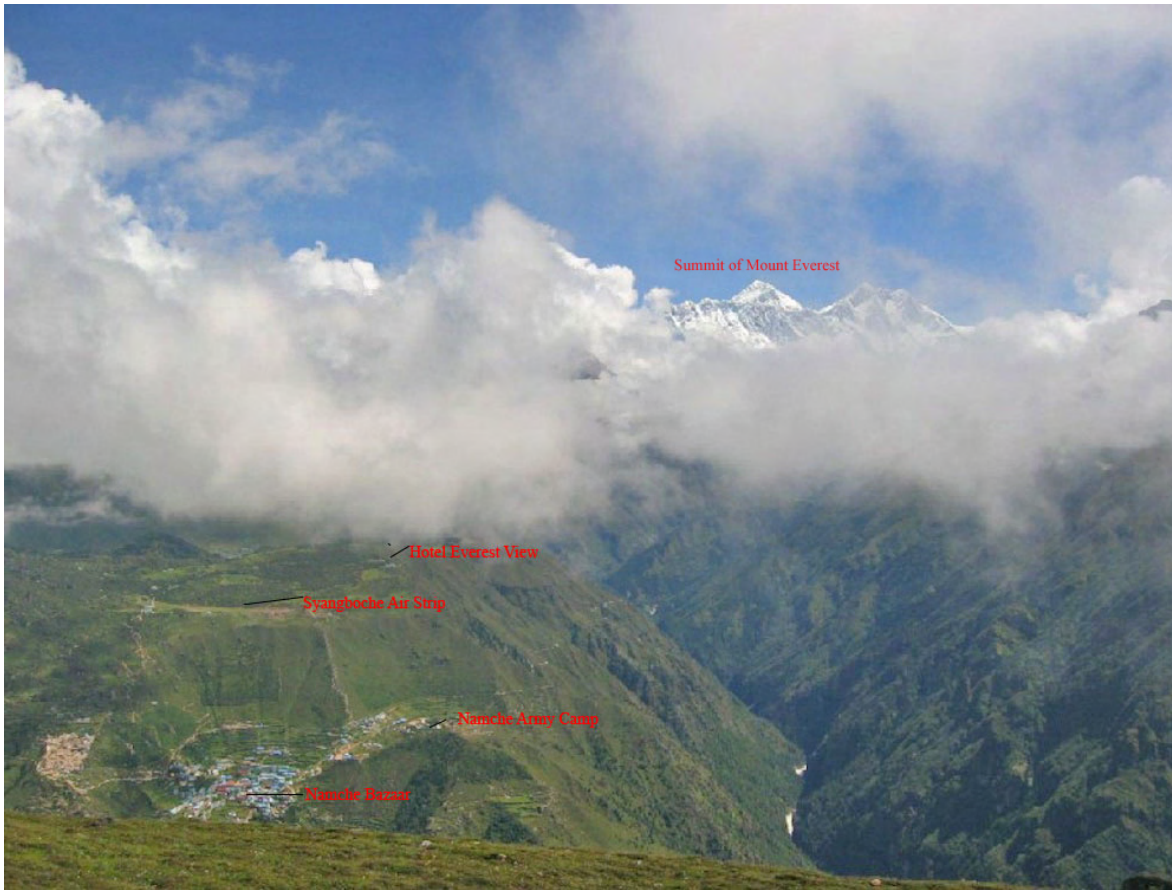
This is the mast 200 meters south of the Everest View Hotel that receives the signal from Rautah. It overlooks the army camp to which the Ubiquiti radio relays the Rautah signal. The mast also sends the Rautah signal five hundred meters higher to Kongde from where it goes in a straight line of sight shot to Chukkung.

Kathmandu area to connect enterprise clients to World-Link.

Shakya: Since the occasion of the 2003 Everest base camp experience I've become much more motivated to work on connectivity in rural Nepal and I dreamt of choos-

ing the Solu Khumbu for an area for development. I focused on Namche as the place to begin.

COOK Report: Is it correct that as a result of your 2003 base camp experience you became a familiar enough with the possibilities of wire-



less so that during the summer of 2005 you lobbied rather extensively within the parliament for reform that would legalize the use of wi-fi in Nepal?

Shakya: Yes that is correct. Up until 2005 the ISM band was illegal in Nepal. But we pushed the matter heavily within the Parliament at that time and finally got the Parliament to approve use at the beginning of the summer of 2006.

COOK Report: And when you say "we" you mean you and Mahabir Pun who with the help of many European and American advisers had built a rather remarkable

wireless network connecting to world link at Pokhara and taking a 30 mile line of site shot to a ridge top in the Annapurnas. See <http://www.nepalwireless.net/> and <http://www.nepalwireless.net/network.php> What happened next?

Shakya: In 2006, I established a company called Gramin Pahunch (GP) (www.graminpahunch.com) which means rural access in English -- Gramin is rural and access is Pahunch. Though I wanted to register the company as "not-for-profit"; due to some legal hassels, I had registered it as Pvt. Ltd. So far Gramin Pahunch has been

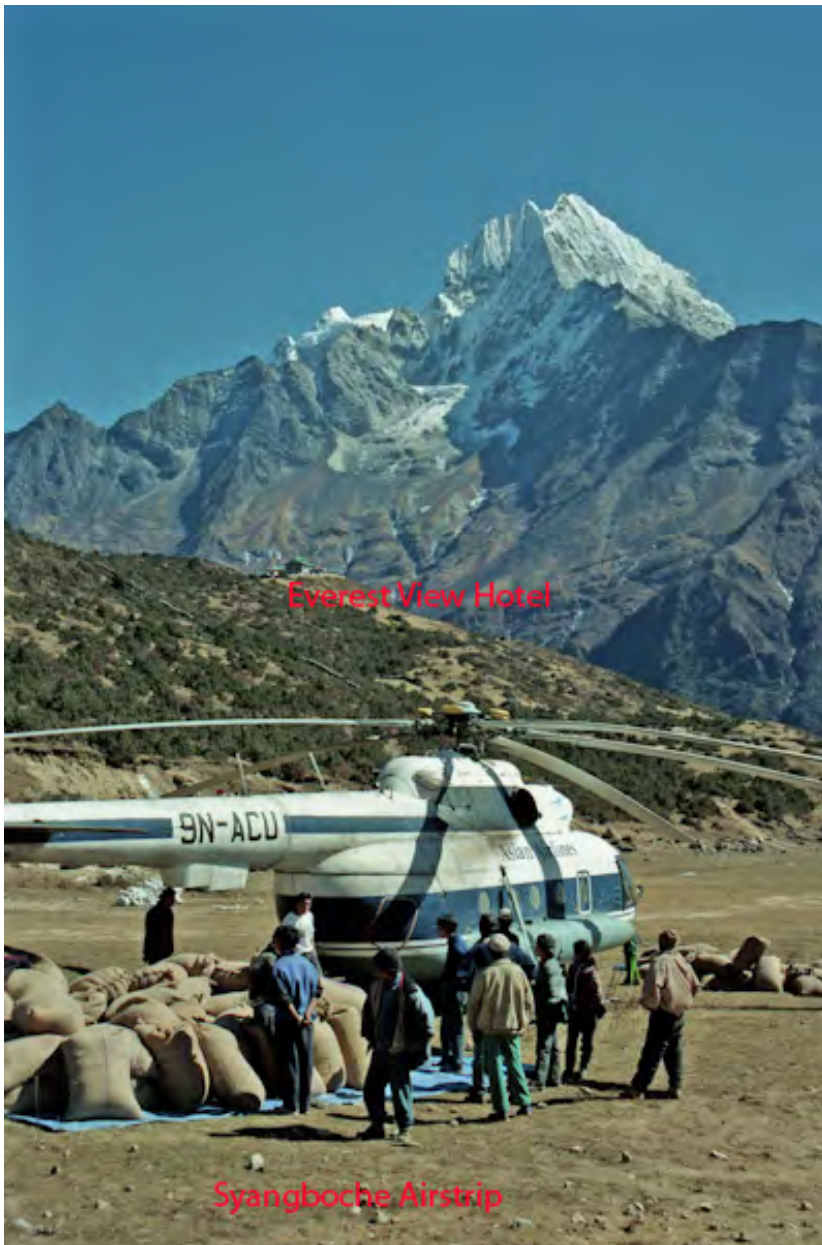
only a one man show due to financial constraints.

Solu Khumbu Business Model

COOK Report: Let's come back to the Solu Khumbu and the question of the business model there. I remember well Dave Hughes yelling at me and maintaining that Mahabir Pun would be doomed to failure because his approach

was grant supported and maintaining furthermore that Solu Khumbu was the only area of Nepal that would be feasible to develop a self-sustaining business model because of the possibility of income generated from trekkers and climbers. Is it your position that, given the initial investment of capital, you could support network development in the Solu Khumbu because of the income that would be generated from foreigners?

Shakya: Yes, as you know having been there many times yourself, this area has a large amount of traffic from foreign visitors who will be



willing to pay for conductivity to the world outside.

Not as obvious to outsiders is the fact that there is a huge amount of economic variability in this region. Namche (3440 meters elevation) is very well-off but many of the villages that are less visited are quite impoverished. To understand the variability if you look at the gross economic product per year of

Namche it comes to a couple of thousand dollars per person. But if you look at the economy in less visited villages you will find that total annual income is perhaps \$200 per person per year.

I am very much motivated by the goal of trying to see how income from ICT in this area can be used to improve the lives of people in the poorer villages as opposed to those villages visited more by for-

eigners.

COOK Report: Would Thame which is on the way to Cho Oyu be one of these villages?

Shakya: Well Thame is less well-off than Namche but it still gets trekking traffic. I am thinking mainly of villages below Lukla. Between there and Jiri As you know very few foreigners take the extra week to walk from Jiri to Lukla. Often men living in the villages below Lukla walk up to there to offer their services as porters.

COOK Report: Where and how then did you begin your Solu Khumbu project?

Shakya: In the summer of 2006 we set up a repeater in Kongde, because, as you can see from the pictures I sent you, [see page 32 and 34 above] this place overlooks the entire area between Namche and Nuptse and Lhotse at the Tibetan border. You have line-of-sight not only to all of the Namche but to other villages in the immediate area.

Pemba Sherpa became my business partner in Namche. He is a young entrepreneur with a prominent personality in Namche and a very good friend of mine. He has invested almost 3.5 Million rupees to setup the VSAT project in March of 2006. He also also had a very good re-

Radio transmitter Rautah to Syangboche 98 kilometers



relationship with the owners of the new Lodge at Kongde -see page 31 above. he convinced them to have me install wireless at their lodges as well as a repeater that could accept a signal from the VSAT and send it back to any spot on the facing mountainside. (The repeater now receives the Kathmandu Rautah link direct from the Everest VGiew antenna mas shown on p. 33 above. **[Editor:** The Kongde Lodge and wiress installation are show in the first three pictures at the beginning of this article.]

Shakya: Apart from the Internet, we are also providing VOIP solutions.

COOK Report: If I remember correctly once you had this set up working the economics of it were not very favorable to you. Why?

Shakya: The problem was that the VSAT bandwidth was limited and expensive and the income from trekkers to pay for it was very seasonal

not more than 10 to 12 weeks in the spring and another 10 to 12 weeks in the fall. During the rest of the year, without any tourists, the income necessary to maintain the system almost disappeared.

We had a very hard time convincing the lodge owners that they should continue their subscription to Internet services when the tourists were not there.

COOK Report: How did you solve this problem?

Shakya: Pemba and I came up with a policy where, during the off-season, we lowered the price. We also charged high enough prices

during the peak season so that we gained enough income to subsidize the use during the summer and winter months.. consequently, we were able to build a pattern of successful network management by increasing the VSAT

bandwidth during the peak season and decreasing it during the off-season. We managed to adjust our usage in such a way as to be able to maintain a year-round contract to keep the VSAT operational.

COOK Report: How did things change in 2008 in such a way that you were able to go all the way from Kathmandu to Namche by wireless?

Shakya: One of the key economic issues had been the ability to bring in enough money to pay for someone with the necessary technical skills to operate the VSAT in Namche. Such a person could find good employment in Kathmandu. Moreover the cost of living for the VSAT operator in Namche was expensive. The expensive bandwidth plus the cost of the network technician made it a difficult economic proposition. I started looking for alternatives to find cheaper bandwidth. I was able to get some help from WorldLink.

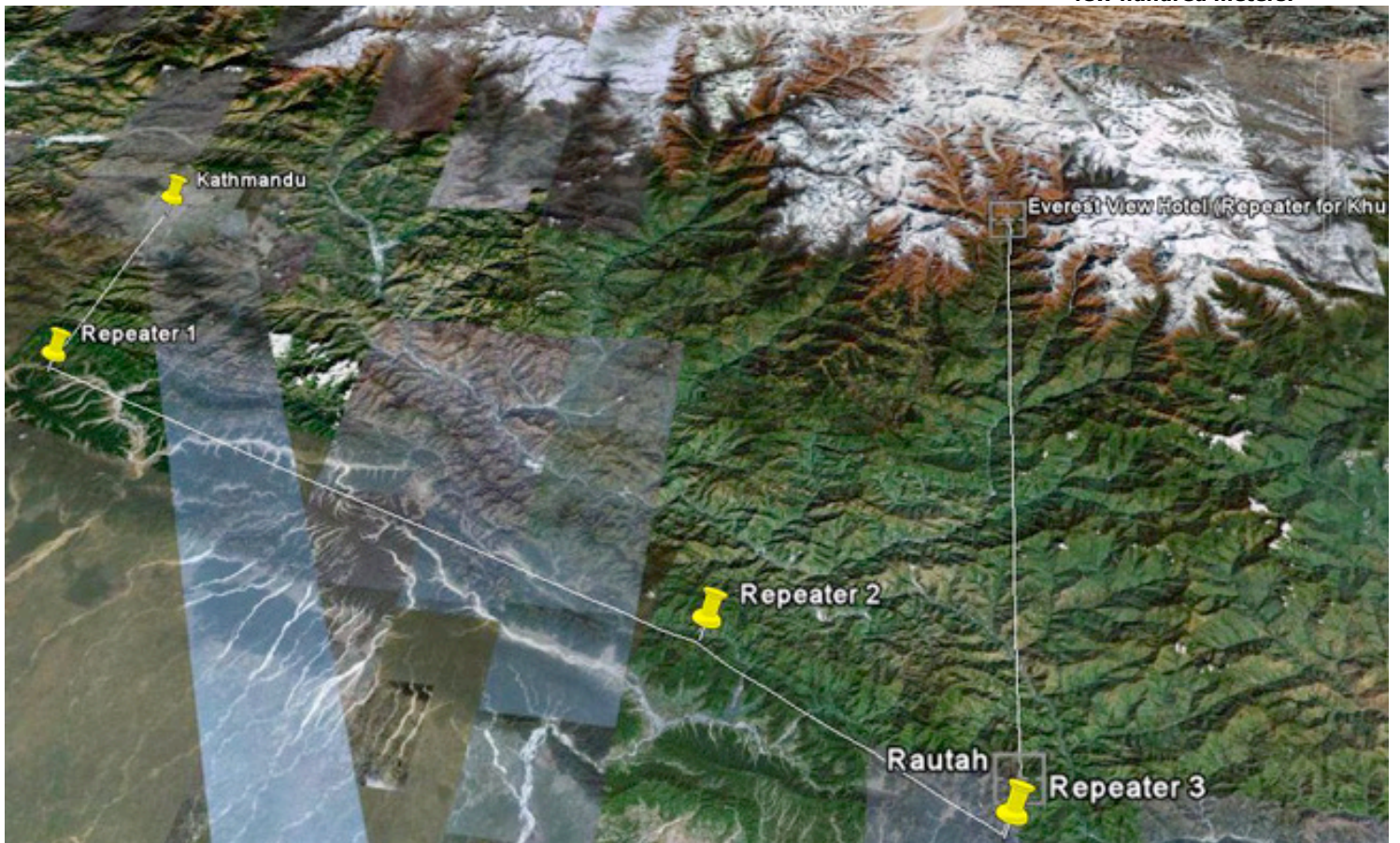


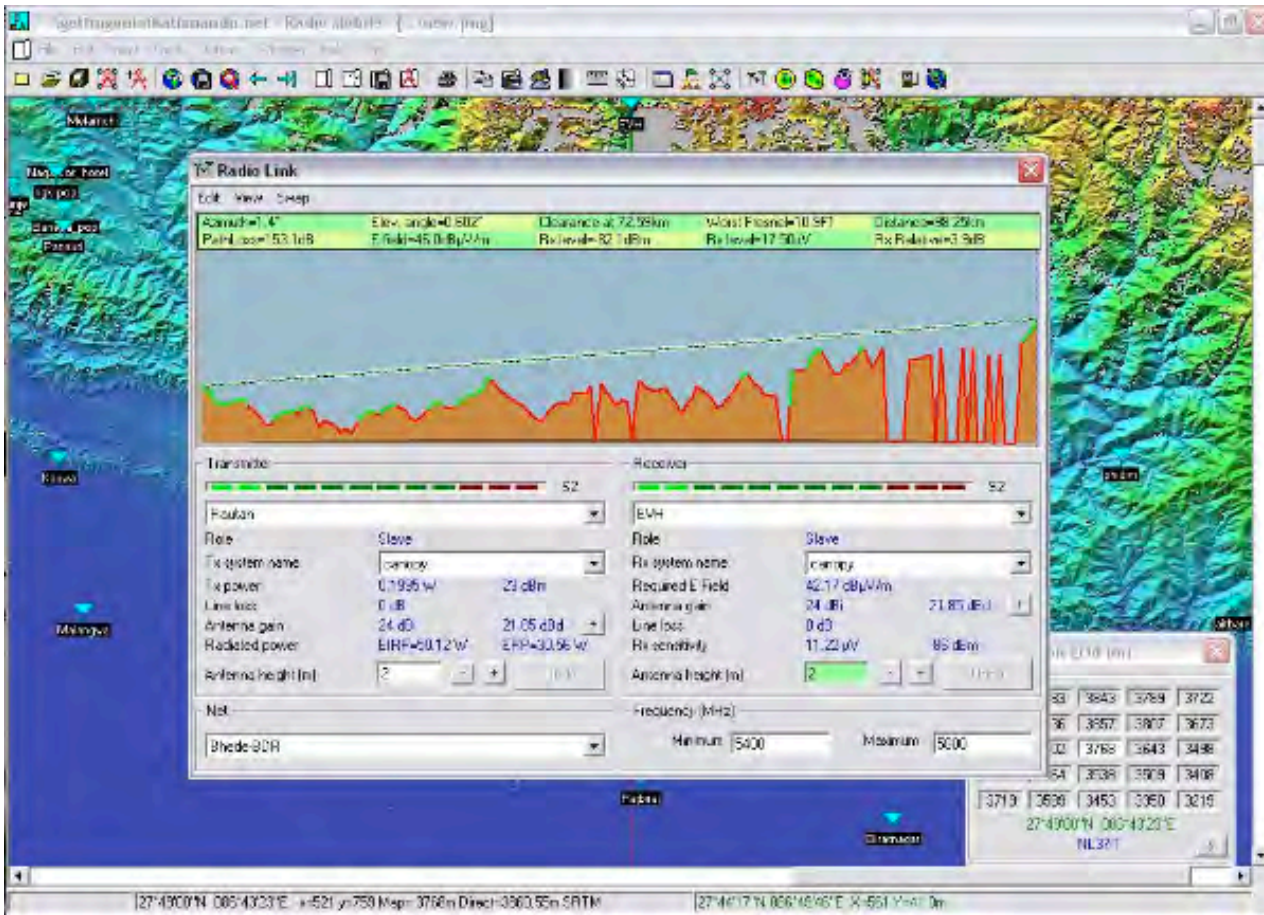
to Everest View Hotel

Solar panels on roof
batteries stored inside

Rautah radio antenna

Repeater 3 - the dish at the bottom of the heavily photoshopped picture to the left is pointed towards the gap or "dip" in the Himalyan crest seen some 50 miles away against the horizon. Compare the map below to get a satellite point of view of the photo. The ridge at Rautah is about 6,500 feet in elevation. The clouds covering the intervening foothills will warm and rise as the day - April 25, 2009, goes on. The small building on the right has solar cells on the roof. The cells feed batteries inside. The looping cord carries power to the radios and antenna on the tower. The small dish at tower's top communicates with the World-Link backbone tower a few hundred meters.





At Left: Radio Link Screen shot. "Pavan writes: the orange colored mountain like structure is created by the software based on the SRTM data to be feed into the software." SRTM refers to Shuttle Radar Topographic Mission. See <http://srtm.csi.cgiar.org/>

could reach that entire distance.

COOK Report: So in 2008 precisely what did you do?

Shakya: We started looking for a place far below in the valley where we could get a clear line of sight to Syangboche which as you know is the helicopter landing area perhaps 250 meters above Namche. Finally we located a place which is almost 100 kilometers south east of Shangboche. This was at a place called Rautah

COOK Report: How did you find the place? Topographical maps and Google Earth? Did you walk around and take a look?

Shakya: We had the support of the WorldLink engineer named Kashab Nepal. He had already installed a wireless link that extended in four additional hops all the way back to Kathmandu. He helped me do a site survey near that final wireless link and found a location slightly higher up on the hillside that had a clear line of sight to Syangboche.

When we entered our GIS data into Radio Mobile it also helped us to test out the link and to prove that the place we had mapped for a link had a clear line of sight to Shangboche and that a radio signal

We could put the GIS data at Rautah and the data for Shangboche into the Radio Mobile software which would do with the distance calculation and include the variation for the Fresnel zone.

COOK Report: If you can give me a screenshot of what this looks like with the radio mobile software that would be quite useful.

Shakya: I can do that. [Editor - the resulting screenshot is found at the top of this page.]

COOK Report: Once you've figured out the location and how did you acquire perma-



Tsring Galtsyn's Cyber cafe in Namche in May 2003.

ment access to the land necessary to site the antenna solar cells batteries and such associated equipment?

Shakya: After we tested things theoretically, we took our radios to the site and tested things practically. We had confirmed that the connectivity between those two places worked, we started looking for the owner of the land. Thank God it was a private individual and not the government. We negotiated a price with the owner of the land and then started to build the tower.

COOK Report: Did the land-owner live nearby? Could you tell him we will give you free monthly connectivity as part of the deal?

Shakya: No that would not

work. We did the deal in cash because he was an older man who did not understand the technology and was not interested in it. He sold me the land directly for cash. But helped me to acquire some of the necessary equipment and I used most of my life's savings to acquire the land.

COOK Report: How did you get from Kathmandu to Rautah?

Shakya: The network from Kathmandu to Rautah involved four repeater stations. Rautah is almost 350 km due east of Kathmandu Valley. [See the network map on the preceding page.]

COOK Report:: So from that last repeater you had a very short radio hop to your tower and its long-range radio that

reached Syangboche.

Shakya. That's correct.

COOK Report: Tell me about the radios themselves has Canopy changed that much in the last few years?

Shakya: I *am using Canopy backhaul at ten megabits per second speed metro* from my repeater at Rautah to the WorldLink repeater in Kathmandu. From that repeater the to the repeater at Syangboche we had been using Motorola Canopy Backhaul BH30 (point-to-point) P2P devices.

COOK Report: I have the impression that the basic Canopy radio system has not changed much in the last five years or so?

Shakya: Well it's very reliable and very powerful as well.

COOK Report: What did these cost you?

Shakya: About 500,000 Nepali rupees for the Canopy radio pair and the Radio Works disk antenna needed on each end. In dollars the cost was \$6500.

COOK Report: What are the distances involved?.

Shakya: From Rautah to Syangboche it is almost 98 km, the maximum possible



This is a class in Namche's Elementary School on a morning in June 2003. Internet access will give a large boost to the education of these children.

range for those radios would be 120 km.

COOK Report: Does weather affect their operation at all?

Shakya: Weather seems to make no difference it is very sharp focused and directed point-to-point.

At Syangboche

COOK Report: What happens to the receiving radio at the Everest View Hotel in Syangboche?

Shakya: At the Everest View hotel we have a Ubiquiti link called Nano Station Five <http://www.ubnt.com/products/nsm.php> that takes the Canopy signal a short hop down to the army camp and from the army camp we run

into another sheet itself by means of coax. the Ubiquiti is cheap and reliable we are looking at using more ubiquity radios in Namche as soon as possible to get service in to multiple lodges.

COOK Report: What connectivity then is next in line?.

Shakya: We have already purchased the equipment necessary to connect Namche to Everest Base Camp. Try to make the connection beginning in September of 2009 and finishing before the onset of winter weather in December.

From Everest View we will be able to reach base camp and two hops with a repeater near Dingboche and a second repeater near Lobuche which

will send the signal up the Khumbu glacier to Base Camp.

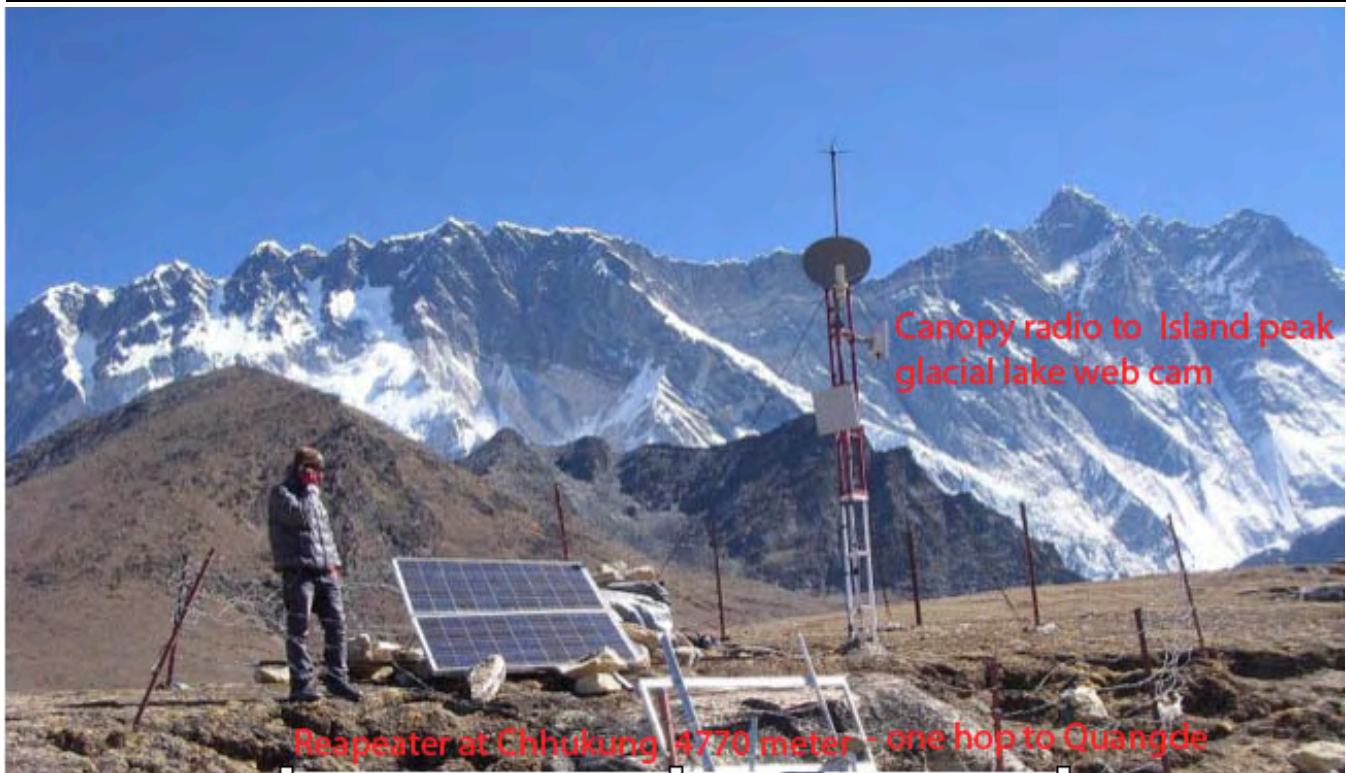
COOK Report: So this will be a communication system for the trackers and the climbers? Who else?

Shakya: It will be for all the villages located on the trekking route: while we have the radios we will need solar power systems and batteries at Diingboche and Lobuche and we are still looking at that expense and while Pemba and I are still trying to finalize the price we will offer to the customers in this price will depend on the amount of money we have to spend for batteries and solar cells.

COOK Report: I guess then you have to do some budgetary and cash flow planning and while you will charge the majority of costs to the climbers and trekkers the costs for local people to use will be about what 10 to 20% of the total?

Shakya: Yes. We are also trying to arrange places where the porters themselves can use the setup for communicating with their relatives in the villages below at no cost. We are planning to set up a couple of free Internet cafés for use only by porters as a part of our corporate social responsibility.





COOK Report: Backup and tell me a bit about your 2007 plans when I understood that you would be paying for half the cost and time but the other half but that your ability to pay got squeezed and what happened? Did Pemba fill the gap?

Shakya: The 50% was for the Vsat only. Since we were in the verge of selling off the Vsat system I could not use any of my savings and I did not have any financial resources to support my share of the 50%. At this point Pemba gave me some kind of loan so that I could pay off the 50% as well. And later when I set up the repeater at Rautah we were again into the 50% partnership. Now this partnership is only for the link from Rautah to Nam-

che and the site at Rautah I had to pay for out of my own pocket.

COOK Report: How does the cost of the VSAT bandwidth compare with the cost of the wireless bandwidth that comes direct from Kathmandu?

Shakya: For a 256 kb link up and 384 down we had to pay almost 80,000 rupees a month for the v-sat. In dollars this is about \$1300 a month. And now only about 50,000 rupees per month for 1 Mb per second service

COOK Report: Where does the fiber connectivity come from? telecom Nepal was putting in fiber backbone I've thought yes?

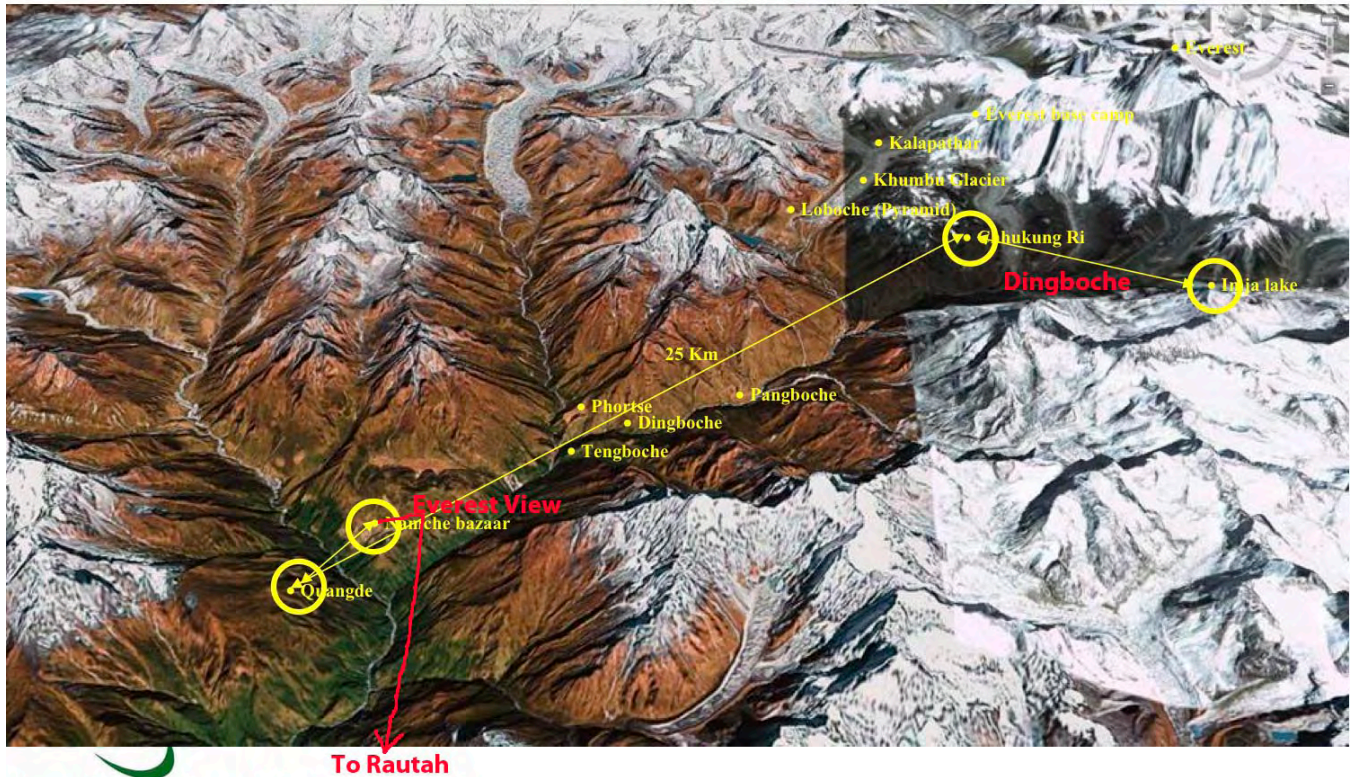
Shakya: WorldLink, my parent company, has brought in the fiber connectivity from India. That is why the bandwidth cost is so low.

COOK Report: When did Di-leep manage to do that?

Shakya: Last fall. It's been almost a year. WorldLink and the other large ISP in Nepal, Mercantile, both signed a deal with a company named Airtel. They brought the fiber from India to the border of Nepal at Bhairahawa and from the border to Kathmandu we are leasing fiber owned by the Nepali Electricity Authority.

COOK Report: So with the larger bandwidth you can operate at a larger scale and have the capacity to serve

Networking of field sensor and transmission station in Mt. Everest region for the real time monitoring of Lake Imja Tsho



Nepal Research and Education Network

This is a slide from Mahabir Pun's 2008 presentation at the ITU. He maps how the Keio University webcam network goes from Kongde to Chukung. However he does not show how the net currently connects to the internet via Everest View and Rautah. When the presentation was made it was by VSat from Namche. I have added the current connection in red. Also Dingboche is shown in the wrong location. I show its correct location in red. Use this url to get Mahabir's slide set: http://www.itu.int/ITU-D/cyb/events/2008/geneva/docs/pun-disaster_mgt_in_vulnerable_env-may2008.pdf

more people which is certainly all to the good.

What can you say that about your business model and planning at this point? Are you working with groups of local sherpas to get them to tell you what their people want. I gather that one of the most basic services is local telephone service and perhaps telemedicine?

Shakya: The increased bandwidth definitely makes these applications feasible and from the same link at Rautah I can also extend service into the Solu area elevations below Lukla. This includes Paphlu. Recently I could also connect another district called Khgotang.

COOK Report: What can you tell me about the use of the Internet for education in this

area that you are opening up. is it too early to say anything?

Shakya: It is early still, but I am still looking for opportunities. I do not want to impose the technology on the Namche community. I believe that's the community must be ready to grasp the technical possibilities on its own. I want the community to come to meet to talk about the technology and not to try to impose it on them.

COOK Report:

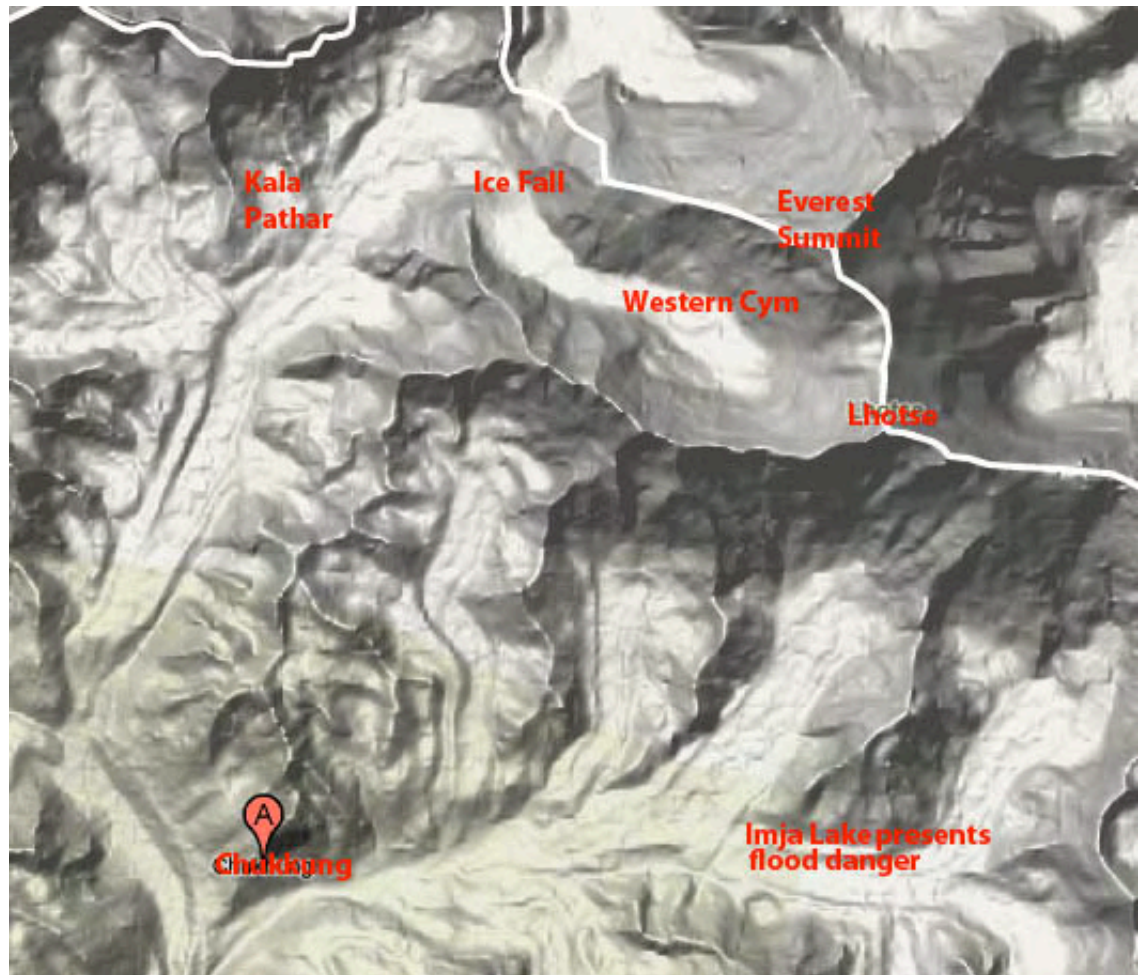
Tell me what happens in Namche? Do you meet and talk with a wide variety of Sherpas, teachers and villagers? How do you take the pulse of the community?

Shakya :

Pemba and I talk to the lodge owners and explain the benefits to them. Recently I was in Namche where I worked on extending the network to Khunde hospital. While there I talked to different communities -- even the monks at the monastery.

COOK Report: I guess what you're saying is that people use the network to learn and explore and when they find out new things they can come to you guys and ask how to approach them further?

Shakya: Yes. I also want to have the Solu Khumbu as a test bed for e-gov services. Although it has been in my mind for some time, I have only just started talking to



the local government (we call it District Office and District Development Committee). I want to connect each village within Solu Khumbu and then connect those villages to District Headquarters. People have to walk for many hours to get to the district head quarter there so I think ICT enabled services help them to cut short their travel time whenever required. Secondly, the robust network can also support few value added services like distant education and tele-medicine programs.

Finally, my plan is to grab the environmental data (like Japanese are doing) and provide it to all who are interested. One of the major causes of change in global environment starts from Himalayan region. So if I can provide ICT access to such areas, it helps achieve two goals -- sustainability of my project and at the same time it gets real time data to scientists and concerned environmental engineers. I do not know whether I will be able to do it all in short span of time but I am determined to try.

I already have an environmental customer. It is a grant project of Keio University of Japan and Sagarmatha National Park to monitor the growth of Imja Lake at the base of Island Peak. The project was catalyzed by Mahabir Pun as a part of his early work on a Nepal Research and Education Network.

COOK Report: Terrific! I have known of Mahbir since December of 2002 when his early project in Nangi village was written up in the *San Jose Mercury* newspaper. At that point in time, to get on the Internet, he had to hike six hours to the nearest bus route and ride another six hours to Pokhara to visit a cybercafe. He has a bachelor's degree from the Univer-

sity of Nebraska and from the late 1990s well understood the importance of developing a network of Western volunteers to help him build what has now become remarkable infrastructure in the Annapurna region of Nepal. [See url in second column page 34 above.] Beginning in 2005 and culminating in 2006 he and Pavan successfully lobbied the Nepalese government for the legalization of 802.11.

As his Nepal wireless.net website mentioned on page 34 of this article shows, he has developed an outstanding network of volunteers in Asia and Europe and America. But his infrastructure is primarily in the Annapurna region perhaps 100 miles west of Kathmandu and not at all

in the Solu Khumbu. Thus for Keio University to implement the Interlake project it had to use your infrastructure. For Web cam data look at <http://fsds.dc.affrc.go.jp/data4/Himalayan/>

Pavan extends his thanks to WorldLink: "WorldLink, especially the Technical Team and Mr. Dileep Agrawal, Managing Director of WorldLink has played an instrumental role to make the network a successful one." Without the support of WorldLink team, the project would not have been a success.

Photo Credits: Pavan Shakya, pp. 30-32, 34, 36, 38. Pemba Sherpa, p. 31, 33, 42, Gordon Cook, p. 35, 39-41, Mahabir Pun p. 43



Pavan Shakya, Gordon Cook, Tsering Galtsyn at Kathmandu Guest house in June 2003 on conclusion of Everest 50th anniversary cyber cafe.

Symposium Discussion September 16 - October 22

What is at Stake as IPv4 Runs Out

Editor: Note the continuing and seemingly intractable nature of this very very major problem. Picking up from September 16 – October 22. Note especially the insights of Tom Vest and the constructive approach of Chris Savage. Note also the increasing participation of Vint Cerf.

Tom Vest: With respect to cases like your hypothetical /25 ~ /24 example, I know that the IP Resource Analysts that would have handled any such requests since the mid-late 1990s (depending on where you sit) would have allocated the smaller of the two possible address blocks. Lots of address resources that were distributed before CIDR and the RIR system were in place are currently either completely invisible, or only partially visible in the form of smaller address routed blocs. Their public non-visibility does not mean, however, that all such resources are idle -- some (unknown) quantity may be actively used in private networks that are seldom (though not necessarily never) exposed to the rest of the Internet...

In any case, the expectation that we might even come close to 100% efficiency of IP address utilization is not well supported by historical experience. The historical anecdotes preserved in these RFCs are illuminating on this point:

<http://www.faqs.org/rfcs/rfc1715.html>

<http://www.faqs.org/rfcs/rfc3194.html>

Savage: Thanks. I get that. I fully understand that for various good reasons we will never get to 100% efficiency. I was asking the much more pedestrian and mundane question of whether (a) in fact, anybody out there is hoarding IPv4 addresses (perhaps in anticipation of an actual market, white, black or gray) and/or (b) if anyone actually knows.

Things are obviously different in the phone world, both because the addressing/routing scheme is simpler and because there is an unquestionable Leviathan (in the Hobbesian sense) in the form of the FCC that has plain and explicit statutory authority over PSTN numbering resources.

But that said, in the PSTN world you have to report regularly on the actual utilization of the number/addresses you have been assigned, and you are forced to disgorge back to the "pool" any that you are not currently using (with reasonable allowances for growth, etc.)

Put in its starkest terms, when everybody is saying "We are running out of [x]," my instinct born of years of experience as a parent is to ask, "Well, how hard have you ACTUALLY LOOKED FOR [x]?" And my instinct as an economist (not to say as a cynic) is to wonder if anyone thinks they can make a buck, either literally or figuratively, by hoarding [x].

So I'm really just asking those two questions, about IPv4 addresses.

John Levine: The short answer is nobody really knows, but the last time I checked, less than half of the allocated space was routed on the public Internet. There are certainly a lot of early Class A allocations that look pretty underused, e.g., MIT's 18/8, General Electric's 3/8, Xerox's 13/8, Ford's 19/8, CSC's 20/

8, Halliburton's 34/8, Eli Lilly's 40/8, the evanescent Interop show network 45/8, and so forth. Some of them may be truly unused, some may be used in private networks not visible from the outside, but until this point there's been no reason to give back unused space so I expect a lot of them don't know themselves how many of their 16 million addresses actually have a host that will respond.

Vest: Hi John, Suppose it really is the case that 100% of the IPv4 that is not publicly visible is completely idle -- which would imply that, theoretically, the Internet could grow to (at least) twice its current size using IPv4 alone, with no additional impact to the current state of e2e transparency (i.e., regardless of whether you think NAT is heaven, hell, or hohum). Now suppose that all restrictions on address resource transfers between private parties are completely eliminated, so that every IPv4 holder who wishes to "sell" the number resources in his/her possession is free to do so, and every aspiring IPv4 buyer is similar free from obstruction to "buy" any number resources that anyone else is willing to sell them.

What do you predict would result from that sort of arrangement? Would the effec-

tive price of IPv4 go up or down?

[**Editor** - a couple of days later Tom's question led to some heated exchange which I have chosen to omit.]

Vest continues: If the former, would it go up so much that it would become a cost consideration similar to, or greater than, the other prerequisites for Internet service delivery (e.g., network hardware, competent technical staff, co-location space, network capacity elements, etc.)? How would market participants be likely to respond in a situation where:

-- Everybody knows that IPv4 is finite in quantity, and very scarce in practice, and; -- Every IPv4 holder understands the value of (their) possessing public IPv4 lies somewhere between "a potentially significant competitive advantage" and "an absolute guarantee of future wealth and/or market power," and; -- Every current and aspiring Internet services provider has a reasonable expectation that the above facts will continue to be true indefinitely, unless/until incumbent, IPv4-holding Internet service providers elect to embrace some other, less constrained addressing scheme (or other method of network attachment)? Also, given the same scenario described above, what do you

expect would happen to the form and levels of (purely voluntary) participation in the existing whois registries, or if you prefer any future competing/successor institution(s) that are intended to safeguard the uniqueness of IP number resources? Do you anticipate an outcome where that future registry/function is "even more useful" or "even less useful" than it is today? What's the basis for your expectation?

What are your predictions?

Levine: It seems obvious to me that as the price of fresh IP space increases, markets will develop, and the main question is whether the RIRs will be actively obstructive, passive, or cooperative. The only stick they have to deter sales they don't like is the ability to refuse WHOIS updates, but since even now ISPs never check that the space they're announcing belongs to the people they route it to, all that means is that WHOIS would become even less useful than it is now.

Vest: The policies and policy changes "of the RIRs" are developed, adopted, and modified solely by each RIR's member ISPs and their representatives. Given that fact, are you worried that what the RIR communities (literally) ultimately elect to do will be contrary to their own per-

ceived self-interests? Or do you think believe that there's some secret conspiracy to thwart or undermine their self-determined policy goals?

More generally, I suspect that what is and is not "obstructive, passive, or cooperative" to a given economic activity is largely in the eyes of the beholder. To test this idea, I'd be very interested in your views on the market for derivatives, esp. collateralized debt obligations and credit default swaps. All things considered, would you say that the policy choice(s) to exempt derivatives trading from all restrictions, and also from most disclosure requirements, ultimately represented an "obstructive" or "passive" or "cooperative" approach toward that particular market (?), toward the market(s) for securities more broadly (?), and toward economic regulation / "managing the economy" in general? Would you say that those policies choices were/are good, neutral, or bad?

Levine: It also seems obvious that to the extent people can build dual stack systems for a small incremental cost over single stack, they might as well and probably will do so, but it's hard to imagine a world in which all of the legitimate hosts you would want to get to won't have an IPv4 address and a route. Botnets, on the other hand,

...

Vest: By the same logic, it should also seem obvious that incumbent telecom facilities owners "should" embrace the construction of / interconnection with directly competing Internet access platform operators (e.g., municipal networks, ad-hoc DIY network collectives, etc.). Perhaps one day they actually will do so. In the world that we actually live in, however, this is not a widely observed phenomenon. In my own experience, once a commercial entity comes into possession of a "bottleneck" resource -- regardless of how (e.g., by conquest, market dominance, regulatory fiat, or passive inheritance) -- they rarely, or perhaps never, seem willing to give it up voluntarily. That said, if your experience are different, I'd also be very interested in hearing about them.

Cerf: Please note the RPKI initiative to digitally sign allocations to aid routing algorithms to detect hijack attempts.

Levine: Good point. I hope the RIRs have enough sense not to try to use RPKI to keep people from selling IP space, since the practical effect would be to tell people that they have to continue to believe unsigned allocations.

On a somewhat related note, is there any work on doing regional route management to shrink the size of the global route table? It is indeed silly that every router in Asia knows that my tiny /24 in Ithaca has two routes to NSPs in New York City, and even with v6, the RIR policies are likely to keep the route table from getting much smaller.

Cerf: The only solutions appear to have a lot to do with topology and peering - unless someone can come up with a system of interlinked IXPs, maybe?

Cole: I have a really uninformed question about "address exhaustion".

If the goal is to have an unlimited set of unique identifiers for "end points" on the network, don't we already have two schemes that do that -- email addresses and domain names? Each uses the "Roman" alphabet plus numbers plus some punctuation characters, so have 40plus candidates for each "digit," rather than 10, and can be arbitrarily long or short, so long as unique. Each also allows for multiple registrars and has a system for disallowing duplicates, and for adding entire new collections by changing the last few letters (new domains, such as biz, firm, info, etc.)

This is so simple it must be wrong -- but why it is wrong might be very instructive to those of us not "living and breathing" IPv4, IPv6, etc.

Goldstein: Rollie, you're obviously not an expert drilled in the ways of the IETF and the religion. If you were, you wouldn't have recognized the emperor's nakedness. You are thus absolutely right.

The customs of today date back to the early experimental ARPANet, when there were few nodes and frankly nobody thought about naming and addressing. Nodes had numbers, and ports on nodes had numbers, just like Strowger switches. Those were addresses. Hosts didn't have addresses, and still don't. Just doing packet switching was a huge accomplishment. Optimizing the details like naming and addressing was a task for the future, but after a while people forgot that it was an unfinished task and assumed that it was correct the first time.

Early networks used a HOST table as an alias for the network address (NCP first, IP later), but the application layer requested services by address. DNS allowed this to scale but still did the translation in the application, backwards-compatible with the earliest experimental protocols. But when you think

about it, applications should NOT know about numeric addresses. It's a layer violation. (Actually, it wouldn't be a layer violation in the original layering, where TCP and IP were one layer, and I think it's still correct to treat them that way, but using numeric PoA addresses in the application is still wrong.)

Applications should thus never include IP addresses. NAT should be transparent. Names should pass down the stack, not be translated. HTTP is a relatively well-designed protocol. It uses names, and passes them, not IP addresses. So HTTP is pretty clean in NATs. FTP set the bad example, but the only reason it put an IP address in the application layer header was because it was needed to specify which physical printer port on the BBN PTIP you were printing to. ("Port" in TCP really did refer to a printer or terminal port on a PTIP. Again, named application identifiers would make more sense there too. DECnet figured that out by 1980 or so.)

If everything is done by name, then addresses become local constructs and NAT is harmless. You wouldn't even need a globally-unique IP address in order to reach something. What a concept... TCP/IP would almost start catching up with the mobile telephone

network, which has a rather sophisticated and effective real-time address translation/lookup capability (HLR).

Vint Cerf: 1. See DTN for delayed binding concepts (www.dtnrg.org) 2. Numeric, hierarchically structure addresses are helpful in keeping routing table sizes down (cf CIDR and BGP-4 with masks). 3. There were a number of competing ideas for IPng - I don't think I was the party making the decisions on that one but I believe we need to implement IPv6 even if we pursue some of the delayed-binding ideas since they are less mature. 4. Splitting IP from TCP helped with real-time applications; tightly binding IP address to TCP connections is something I would change in a clean sheet design.

Goldstein: What's necessary for NAT to work is for servers to have globally-recognized addresses. That does break the "peer to peer" notion behind BitTorrent, the original Napster, et al. But I question whether clients *should* be servers at all. And if they need to be, there are still workarounds based on rendezvous points, for instance. It's these horribly inefficient sub-rosa content distribution networks, that drive ISPs mad and raise costs for everyone, which are potentially impeded by NAT. I'm not crying for them.

Marks: IP is designed to be peer to peer, which is clearly why you hate it so? Sadly, your client/server thinking has become widespread in network design, hence asymmetric bandwidth, bans on running servers and other pathologies.

Goldstein: No, you totally misunderstand my position. Rollie raised the issue of using names rather than numbers and I pointed out examples of applications that don't, and, like many, thus depend on unique numeric addresses.

Client/server (one way) is a degenerate case of the more general peer to peer. The public Internet grew up with client/server assumptions including consumer-service ToS banning servers. Some was based on presumed demand (web browsing was the big thing), some on asymmetry of supply (a serious problem with cable in the US, less so in Europe), some to control costs (no metering = averaged rates). A number of peer applications were written by amateurs (Napster Fanning, Bram Cohen, etc.) who were hardly rigorous protocol architects and who relied on the visibility of IP addresses in the application layer. These have problems in layered networks (NAT being an inadvertent exercise in layer enforcement).

Marks: The 'sub-rosa' protocols are ways to work around these design flaws in current middleman networks. Clearly people want to share and distribute a wide variety of different, large media. As they can't just serve them to each other, we have arbitrage models that enable this. YouTube is one. Bittorrent is another.

Goldstein: Work around design flaws? I'm afraid that the problem is that they don't -- they often depend upon assumptions (no mid-path NAT, for one) that maybe shouldn't be made. What they were largely designed to do is work around copyright law. ISPs prefer to have servers at their colo sites, where capacity is cheap, but they are subject to take-down and liability. Or worse. (Dallas!) Napster (which inspired the bunch) and BitTorrent (which removed the central server vulnerability) were ways to be sort of anonymous and avoid take-down, as well as increase on-net storage beyond the web hosting allowance granted by most ISPs (who want to avoid take-down).

Not that I'm necessarily opposed to this. I'm happy to let the RIAA fight their own battles. But a name-based protocol could work better than a number-based one. Not that most people know

their own node name, but reverse DNS lookups, for instance, are already possible. If names, not numbers, were the normal at the application layer, the infrastructure would probably be more attuned for it.

Delayed Binding? Use of Names Rather Than Numbers?

I also appreciate Vint's raising the idea of delayed binding, which is a useful tool. The whole Akamai thing and CDNs in general are examples of how delayed binding can be used to accomplish an optimized anycast service. Sadly, most "peer" programs do no such optimization, though the P4P effort at least provides handles for voluntary participation by, in effect, providing a sort of delayed binding.

Marks Pretending that that the dominant sources of demand for bandwidth worldwide are irritations that should go away is a strange way to argue.

Goldstein: HTTP is a well-designed protocol that tolerates delayed binding and NAT well in large part because it uses names rather than numbers. The widespread "peer" programs out there are, sadly, not as well designed. I hardly see them as an excuse to go to IPv6, just

so that they can continue to build upon a layer violation. Since NAT-based networks do not give everyone their own global number, and NAT **will** grow even if only on a dual-stack transition to v6, some other approach needs to be developed. If it's illegal, then doing this with a vulnerable (to law enforcement) name server might be problematic, but I'd be hard-pressed to justify an investment in IPv6 on grounds that it's better for doing illegal things. Indeed what would it do for v6 if it turned out that its "killer app" was doing things that the authorities didn't actually approve of?

(Cue the song from Avenue Q, Trekkie Monster singing "The Internet is for Porn".;-)
)

Cerf: Fred, name-based systems run into scaling problems for very large scale networks because of large routing tables. Names don't naturally fall into topological hierarchy as network addresses can. They form nice management hierarchies (cf DNS). The net of this observation is that routing scales better with topologically structured addresses. Naming gives much more flexibility for mobility, multi-homing, multi-cast, delayed bindings, and so on.

Goldstein: You've brought up a lot of good issues in a

very short space there!

Large routing tables **are** the looming big problem. So whatever is done needs to solve that problem. Names generally require translation by a directory. So name-based networks should not follow the DNS model, which was great for its day, but should do more. Think HLR, albeit not exactly the same, and more open and redundant. [**Editor:** The *home location register (HLR)* is a central database that contains details of each mobile phone ..] Merge the routing problem with the name resolution.

First, the primitives (information passed across layer boundaries) below application should contain the name, not an IP address. Applications thus never query the HLR server; it's queried at the lower layers as required. Application-name, not IP address/port, is what lower-layer entities see.

Rather than propagate all routes to all routers, what if we only propagate routes to a collection of HLR-like servers, which in turn provide the querying device (not an application, but the lower-layer entity, as in router) with routing information? This is not something akin to an IP address (single fixed global number), but something akin to a list of routes to use to

get from where you are to where you want to go. These servers dynamically keep track of network topology.

Of course the query is not on a per-datagram basis, but on a per-flow-establishment basis. Yes, this is sort of connection-oriented, but it needn't carry any of the burdens of say X.25; it just uses a locally-significant (not global) flow ID to let the intermediate systems quickly route the packets. (Larry Roberts and lots of others are pushing flow-based routing too.) Depending on the needs of the application, tools for rerouting could be built in, to enable mobility. (Again, think cellular.) Hence nothing needs or has a fixed static IP address.

Scaling of these servers is accommodated by having more than one layer in the underlying network. So local changes in a distant network don't propagate any farther than necessary.

And those benefits of naming become more easily available.

Cerf: IPv6 doesn't necessarily solve the scaling problem, since you can build much larger internets with IPv6 than you can even with IPv4+NAT, but you can adopt strong topological assignment

rules for numerical addresses to constrain the forwarding table sizes.

Goldstein: I'm concerned that IPv6 has been around long enough that the topological-rule horse has already left the barn. As people want multihoming, they want provider-independent address blocks, and we're back where we started from. There's enough space there to allow a new set of rules to be established, with only those new, strictly hierarchical, addresses to be the propagated public ones. But it's still fundamentally a single layer, a flat address space, and the Internet is not hierarchical in the PSTN sense, there's no single, clean topology. (Is this more a node on Google's network peered in France, or is it more a node on a French network belonging to and directly linked to the rest of Google?) I suppose that's both a strength and a weakness of the Internet!

In Search of the Scalable

Cerf: We all know we still have work to fashion more scalable systems. Adoption of IPv6 at least eliminates the IPv4 runout while preserving end/end path formation. Ideally, we'd be inventing replacements for TCP and UDP and RTP and so on that bene-

fit from delayed binding of name-based identifiers that map ultimately into IPv6 addresses for routing purposes.

One of the intriguing problems associated with more flexible use of naming has to do with when one does the binding of name to address. Traditionally this is done prior to setting up, eg, TCP connections or UDP associations. For mobile operation, the bindings will change. The end-point identifier (name) needs to be re-bound when the associated address changes. Just where, when and how the rebinding is done and how the end-points reconfirm their identifies (otherwise this is a hijack) is part of what makes these ideas so interesting to explore.

Goldstein: Indeed. Mobility requires some way to re-route. Again, I'd take a clue from the mobile-phone world. Phone numbers are application-names, not addresses. The address is hidden behind the scenes. Using the rather improved concepts from LTE: Local changes within a network (i.e., cell to cell) are handled by a Mobility Management Entity (MME). Mobility between networks is handled by a Home Location Register (HLR). But since we're talking Internet, it has to be structured for more competition and less carrier-like control

than the 3GPP membership would want. That's in interesting problem but I think it's tractable.

Cerf: Fred, one of the problematic aspects of packet switched communication is the breadth and brevity of communication between or among entities. Anything that leads to round-trip time set-ups will conflict with the ability to transmit data to many recipients (here I mean unicast, not multicast) quickly. This is not to argue against your ideas expressed below but rather to try to understand the side-effects of architectural choices on performance.

What Markets Might Look Like

On September 24th **Tom Vest:** ..and the competing view that I've described starts where John's own prediction about IPv4 remaining "the only significant protocol used between networks indefinitely" trails off, and postulates that (ceteris paribus) under such circumstances even the near-term survival of competitive, self-regulating, transnational markets for Internet address resources, and ultimately for Internet services more generally, is a relatively low-probability outcome.

Nuff said,

Savage: 1. Competitive 2. Self-regulating 3. Transnational

Which of those characteristics of the market do you think will disappear as IPv4 addresses assigned from the RIRs are used up? All? Which first?

Vest: Will try to briefly suggest the logic behind my observation, then leave the rest to your imagination. I desperately hope that Fred is correct, but the reasoning that he offers below doesn't instill much confidence.

Goldstein: I suggest none. Competition continues to exist in most countries

Vest: During the period between (a) the exhaustion of the unallocated IPv4 pool and (b) the day when possession** of IPv4 ceases to be an absolute prerequisite for enjoying "autonomous" status as a provider of routing or other Internet-based services, the prospect "competitive entry" will cease to exist in all countries -- or at least, in all countries that are enmeshed in what we call "the Internet" today. New entrants may continue to emerge during that period, but each new entry will be contingent on securing the permission of incumbent services providers (and also, implicitly, of competing

speculators or "market makers"), in the form of an "IPv4 transfer" of some kind. My guess is that "fee simple" IPv4 transfers -- the only kind which would provide the same degree of commercial freedom of action that incumbent IPv4 recipients have always enjoyed -- will be both very expensive and rare.

Levine: You've certainly said that many times. But in view of the vast amount of unused or underused v4 space that could be freed up for sale, why would it be so? Do you really expect all of the bazillion entities that have been assigned v4 space over the past 25 years to act as a unified cartel to exclude new entrants?

Vest: Not at all. I don't expect them to coordinate their behavior with each other in any way whatsoever.

However, for all who are not cognitively impaired, I do expect them to define their *current* private interests based in part on their expectations about the future. -- i.e., to coordinate with themselves, inter-temporally. I'll repeat for the last time that this is (AFAIK) not like any other private unregulated market that's ever existed. There is no renewable supply, and there is no currently viable substitute -- and *everybody knows this.* In order

for there to ever be a viable substitute, the individuals who *individually* privately benefit most from the the absence of a viable substitute will have to support its emergence -- and everybody knows that too. Why would they do that, unless and until some exogenous development casts doubt on the sustainability of the status quo?

Savage: Tom, Putting on my economist hat, I have a question here. It seems to me that there are some applications for which NAT is OK. So a NAT arrangement is at least a partial substitute for IPv4 addresses.

Vest: Yes, NAT is a partial substitute for a subset of possible activities. It is, in this sense, the same kind of substitute that would be created if all of the "cash money" held by every individual "consumer" were replaced by a different department store charge card. Over time, many consumers who needed things that were not available in their own "home" department store would probably develop various specific bilateral mechanisms to overcome their purchasing scope limitations, but the result would be a sorry mess indeed, compared to the old open cash days. Worse still, the department stores might decide to change the technical parameters of their charge cards at any time,

raising fees, preferring some partners over others, or even blocking all out-of-store transactions. Of course, maybe none of them would ever exercise that power under any circumstances. Maybe.

I wonder what would happen if a consumer trapped within such a system attempted to buy the inputs required to build their own competing department store and launch their own competing payment mechanism? How would those inputs be priced, I wonder?

Getting Routed

Savage: Similarly IPv6 addresses (even in a world in which not everyone can see or route to them) is at least a partial substitute for IPv4 addresses.

Vest: Today, IPv6 provides the same kind of partial substitute that NAT and private addressing provides -- both to those who also have some IPv4 of their own, and to those who do not. That is to say, if you HAVE IPv4, it has all kinds of potentially very valuable uses, including facilitating traffic exchanges between your own resources and the rest of the Internet. Also, just like today, if you HAVE NO IPv4, then IPv6 can still be very useful to you in an isolated context -- but it

won't enable you to communicate with any of the rest of the Internet, not without the direct assistance or permission of someone else who **does** have IPv4.

Savage: This works both for people who have IPv4 addresses today and for those who don't. So theoretically some people with IPv4 addresses could be induced to move behind a NAT to free up those addresses.

Vest: Within the current structure of addressing and routing, there are three classes of entities: those that have IPv4 for their own infrastructure, as well as IPv4 that they can assign to other institutions; those who possess "provider independent" IPv4 addresses but who cannot sub-delegate them to other institutions; and those who are the passive recipients of IPv4 assignments from the first group.

(I leave RIRs out of the above because they have no direct stakes in the routing services market, other than a general dependency on its continued existence and growth).

In a world of exclusively voluntary, self-interested compliance with routing and addressing conventions, the distinction between the first and the second group will likely collapse. However, the

third group, of "IPv4 assignment tenants" will still be subordinate to their assigners -- and such "customers" can simply be compelled to vacate IP addresses at their landlords' discretion, just as landlords enjoy broad discretion to evict tenants today, e.g., by declining to renew their leases. So yes, a lot of inducing is quite likely -- again, think Manhattan, but without rent control.

Savage: And some people who would really like universally reachable IPv4 addresses can/will settle for being located behind a NAT or IPv6 addresses.

Vest: Many people would also give up their cash for the department store card arrangement too, for example if you gave them a 20% discount on their first purchase. Many people never consider how that makes them henceforth subject to changes in terms that are non-negotiable and absolutely beyond their control.

Savage: In other words, it's not a black-and-white, "prosper with IPv4, die without it" situation.

Vest: No doubt you are correct. "There are levels of survival that many people would be prepared to accept," especially given the lack of awareness among most to what they'll be giving up, at

least until after it's the deal is irreversibly done. In the long and colorful history of the rise and fall of liquidity systems, this phenomenon is called "Gresham's Law."

Savage: I'm not making any predictions here about how "the market" for addresses would work out, but the fact that different businesses with different applications will obtain differential benefits from IPv4 addresses, being behind a NAT, and IPv6 addresses suggests that some kind of trade/market mechanism could actually improve things, in the absence of some Leviathan directing everyone to move to IPv6 or imposing binding rules on the sharing/reallocation of remaining IPv4 addresses.

Am I missing something?

Vest *///If you are, it's only a full appreciation of how amazing and improbable is the thing that we're about to give up. This is only the second time in human history that a completely novel liquidity mechanism has emerged out of the spontaneous interaction of independent economic agents. It represents a model of how liquidity systems can and *should* work under conditions of "abundance," e.g., in a world dominated by non-rival real factors. The fact

that it has spawned such a vast, diverse, and thriving/innovative economy in the *absence* of a pervasive/continuous monetary payment mechanism represents a direct challenge to the world views of many of the more reductionist schools of economic thought -- and this is one of the reasons why this particular view induces such an angry reaction in some quarters. Consciously or unconsciously, the reductionists recognize it for what it is: a description of a world in which their entire understanding of what motivates people, and how economies work, has been falsified (or at least de-universalized).///

*Okay, I thought twice and still decided to leave that passage in, despite knowing how it's likely to be received by skeptics, much less my usual critics. If this seems too over the top to you, just refer back to the cash vs. credit card examples above -- they point to a large collection of more concrete answers to the same question.

Cerf: to Savage: the primary thing you may be missing is that IP addresses are not useful if they cannot be routed.

Savage: Vint, I think I get that. But maybe I need some help. Tell me which (if any) of the following statements are wrong:

Partridge: Hi Chris: You asked Vint but I believe I know the answers to some of the questions and thought I'd chime in.

Savage 1. Today, right now, some Internet transport/routing providers can and do route to others using both IPv6 and IPv4 (in a "dual stack" arrangement); but some just do IPv4. Those that just do IPv4 can't route to an IPv6 address.

Partridge: Yes.

Savage: 2. Today, right now, some host entities don't know how to resolve an IPv6 address and so if confronted with a request to send packets to one, generate some kind of error.

Partridge: For practical purposes yes. (I can take you through all the steps and point out where this sentence simplifies but the result is as described).

Savage: 3. Today, right now, "hosts" located behind a NAT are not directly reachable by "the entire Internet." Instead, they live "behind" a routable address assigned to the NAT "box" itself.

Partridge: In general, yes, though there are ways to make individual hosts "visible" behind a NAT in the sense that packets for a particular service (e.g. a web site) will always go to the same host.

Savage: My point (unless I am confused, which is likely) is that (a) NAT today already breaks the "end-to-end, everybody can directly route to everybody" model, which imposes some costs; and (b) some people today are getting IPv6 addresses and assigning them to their hosts even though there are routers out there "on the Internet" that don't know how to handle IPv6 addresses. If those two are correct, then having "an address that cannot be routed" is not a binary condition, at least not in practical effect; and having some number of boxes with not-quite-fully-routable addresses associate with them does not bring the system to a screeching halt.

Partridge: Here it gets complex.

If you have an IPv6 address and I have an IPv6 address there are lots of ways that you and I can communicate even though routers in between only speak IPv4. In brief, we or our providers create (either permanently or on-demand) an IPv6 overlay on the IPv4 network. There

can be various operational and security issues with doing this but in many cases it just works. Vint and others, please correct where I'm wrong.

Kevin Marks: If I am behind a NAT on IPv4, but have an IPv6 address and stack on my machine, can that be routed globally? Is that a way to drive IPv6 adoption?

Vest: You're describing the kind of connection that a "customer" has. So without getting into any of the technical details, the answer is that packets will get to you one way or another, as long as your ISP enables/permits them to.

Now try asking that question again, but from the perspective of an aspiring new entrant in the Internet services market: the answer is quite unequivocally "no."

Ways to be Reachable

Savage: Tom, again to inject a simplistic PSTN analogy: If I want to compete in the local telephone market -- that is, to offer plain old phone service to customers -- I have to be able to give my customers a phone with a dialable number. Otherwise I'm not able to be an effective phone company. On the other hand, back when we had monopoly local phone companies, one

thing they tried to do with competing services, like cellular, was to push them to interconnect "like a customer" rather than on a peer-to-peer basis. In the old-old days, this is why, if you wanted to use MCI as your long distance carrier, you had to dial a local phone number (like you were calling "a customer"), get a tone, input your account number for billing, and then dial the number you really want to call.

Vest: That analogy is pretty close to what the future might look like, with the following proviso: If MCI had both IPv4 and IPv6, then they could offer you that kind of phone number and asynchronous "bypass" service. The minimum price that MCI could charge for such a "remote long distance" service would be determined by their actual long-distance service delivery costs, plus whatever transit fees that your local dial tone provider demanded. In that scenario, of course, MCI is an IPv4-based incumbent -- i.e., they possess enough IPv4 addresses of their own to at least independently support the technical possibility of interconnection with lots of other IPv4-based local access providers. Other would-be long-distance competitors that came along after the IPv4 runout would be excluded from that market as well.

As I recall, in places and times where the law both permitted that form of competition and also forbade local access facilities owners from hobbling it and/or blocking it altogether (or else they lacked the technical competence to do so), then that provided some level of competition. **Many places and times did not fit that description, including the present day. In any case, I don't see a whole lot of independent infrastructure-owning long-haul providers these days, i.e., ones that do not also own their own access facilities platform somewhere. There may be a lesson there: in the end, control of a bottleneck input trumps all other competitive advantages.**

When Addresses Run Out Routing Comes only at the Whim of Existing "Big Guys"

Savage: In the middle-old days, it's why when a cellular company wanted to connect to the landline network, the landline company wanted to have the wireless switch connect the same way a business PBX would connect.

What you are saying is that if we run out of IPv4 addresses, and some new guy comes along to try to be a real provider of Internet connectivity in

competition with existing players (who are who, by the way? Level 3, Verizon, AT&T, Comcast...?), they will be hosed.

Vest: All of the above. However, as I mentioned earlier, a large share of "autonomous" routing system participants today are not interested in providing commercial routing services to third parties. They just want to be able to manage both their intra-corporate network services, and also the interconnections between themselves and the rest of the Internet. In the future, people in this category will also be hosed (although in many ways the use of IPv6 would make them slightly less hosed than using non-unique RFC 1918 addressing).

Savage: And the reason they will be hosed is that they will be unable to offer THEIR customers independently routable addresses, because the new guys addresses will all really be subsidiary to the network of one of the existing big guys.

Vest: They will not be able to exist themselves as independent self-providers of routing services, nor will they be able to enter the market for providing

routing services (including hosting and IP transit) to third parties.

Savage: Is that a fair statement of your concern?

Vest: The above is a fair statement of the triggering conditions that will result in profound and possibly irreversible changes in how the Internet works, and how it relates to other institutions (e.g., national governments) and economic sectors, and also its capacity to enable and promote creativity, innovation, and free speech.

That's a fair statement.

Earlier **Vest** :I'll also repeat for the last time that I'm not implying that every IPv4 holder today is actively scheming, or even looking forward to this development, although at least a few clearly are. But even if every single IPv4 address holder has the most benign of (private commercial) intentions on the day before IPv4 exhaustion, and IPv4 exhaustion still happens, then the day after everything will be different. Changes in material circumstances impose changes in business plans -- everybody who's ever been in business knows this. On the day after, the universe of functional IP addressing will

have been effectively "enclosed," and the holders of IPv4 will very quickly come to recognize that, like it or not, they have become the land barons of the Internet economy. What do landlords do? They become land developers, carefully nurturing/cultivating the profitability of their unique assets with an eye toward max. profitability over the long haul. To do otherwise would be, as they say, "irrational"...

So you see, they don't have to collude at all. All they have to do is be individually rational, and not stupid.

Earlier **Vest:** **Exclusive right of use to unique globally routable IPv4, free of any prior binding conditions unrelated to technical justification.

Goldstein: If RIRs stop giving out IPv4s, then a market will open up, and there could even be competition among market-makers (eBay, etc.). Plus there will be competition for ways to conserve and make more out of (better NATs, name-based applications, etc.).

Vest: When the RIRs have no more IPv4 to give out, they will stop giving it out. After that competition will indeed break out, including competition between very profitable IPv4 sales opportunities today vs. even more

profitable IPv4 sales opportunities in the future. IPv4 is not a renewable resource, and everyone knows (or thinks that they know) exactly how much is out there -- so this whole exercise is going to play out very much like the pre-declared last turn in an iterated prisoner's dilemma game. Every day, every potential seller will be wondering whether or not an immediate sale is going to make them feel like an idiot (or force them to turn down a new customer) tomorrow. Every day that passes while IPv4 remains an absolute bottleneck will continue to ratchet up that pressure. It will never go down until IPv6, or some completely orthogonal new technology provides a credible prospect of eliminating that bottleneck.

And who's going to be in the best (or perhaps only) position to influence the pace of adoption of such a technology? The same entities that have inherited control over the neck of the bottle, which provides the only means of getting to everything inside it.

Goldstein: Self-regulation is inherent where allowed. With no new addresses being given out, the RIRs will lose authority -- they lose their tool. They could become market makers too, of course. But I fall back on my definition of what Internet

really and truly means:

A voluntary agreement among network operators to exchange traffic for their mutual self-interest.

Vest: Fred's definition may be valid in some sense, but it is not useful -- except perhaps as a normative or aspirational declaration, aka "call to arms". Substitute "economic agent" in place of "network operators" and you have the canonical description of the world according to the subjective theory of value, ala Austrian economics. Okay, so what does that mean to the vast majority of people who do not embrace that world view (and who would be no more likely to embrace if even if they knew what it was)?

Goldstein: This is not centralized; it's a multilateral marketplace. And these voluntary agreements may end up recycling, uh, fallow address blocks that are nominally reserved. RIRs are voluntary, after all, as are ICANN name servers -- they exist to prevent ambiguity, but that's merely an optimization.

Vest: Fred is correct here, but only in the sense that a car would still be a car without the "optimization" of being able to move, drive, get you from point A to point B,

etc. When purely voluntary, self-interested compliance becomes the only guarantee of IP addressing uniqueness, or "non-ambiguity", then eventually someone will make recourse to legal remedies when "their property" is threatened or harmed by someone else's actions. Property laws (as well as military defense/security powers) follow the contours of national boundaries. When/if anyone anywhere chooses to invoke such remedies -- and succeeds -- I suspect that all of the other property rights/military defense jurisdictions will rapidly follow suit.

Perhaps within each legally-secured (i.e., national) routing and addressing zone, the Internet will continue to be self-governing... what do you think the odds are of that?

Goldstein: And it's certainly translational; why would that change? There's no central authority. Anyone can do Internet. I'll raise you a /10 for your two /16s. Pass the BGP, please.

Vest: I think Fred means "transitional" here. Unfortunately, knowing that something is transitional doesn't tell you anything about how long the transition will last, or about what comes after...

Savage: Being historically a PSTN guy, I am drawn to the

analogy between a PBX trunk group in which the only dialable number for the business is 736-5000, which gets you to an operator (live or mechanized) to whom you have to give someone's extension (analogy to NAT); versus a "direct inward dialing" PBX trunk, like mine here at work, where you can certainly reach the operator by dialing 973-4200, but you can also reach me, directly, by dialing 973-4211 (analogy to hosts in a sub-network having their own routable address).

Vest (earlier): Would possession of a PBX enable one to independently provide telecom services to third parties, i.e., to compete directly with the PBX owner's own telco?

Savage: Well, I don't want to push PSTN analogies too far, but the answer is basically "yes." On the one hand, by connecting PBXs with private lines, one can provide "routeable" long distance service. Telecom veterans will recognize this as the "leaky PBX" problem..

How TCP/IP Decoupled the Telecom Bottleneck

Vest (earlier): In this scenario, who provisions, and sets prices, and defines terms of use for the private lines?

You probably see what I'm getting at. If this is a valid analogy, then it leaves me puzzled: If PBX technology, which dates back to well before the 1980s, truly provided an effective, stand-alone substitute for the mix of technologies that had previously represented a competition-proof bottleneck to telecom service provision by new entrants, then why was the AT&T breakup necessary? In fact, since I believe PBX predated the establishment of the FCC, why has there ever been any support for any competition-oriented regulation at all?

Many close readers will spot the trick, but in my experience few go on to notice the even-deeper implication. Like many other industries, the communication sector is vulnerable to a variety of potentially competition-crippling bottlenecks. Historically, control of facilities/infrastructure -- and especially the "ends" of the physical network platform -- has always been the most problematic of bottlenecks. By enabling a service provider to decouple the logical "ends" of a service from the physical ends of the network facilities substrate, TCP/IP provided an imperfect half-remedy to this bottleneck, in this sense: if either of the communicants at the two ends is not physically constrained to a specific fixed

geographic point, then that mobile factor can relocate to some place where service delivery is not bottlenecked. This is probably the single most influential cause behind both (1) the early dominance of client/server architectures, and (2) the early (and still-lingering) hyper-concentration of internationally-oriented online content and services in the US. After the US was first to liberalize both "long distance" and data services, it became much easier for Internet application and service developers to envision/implement one end of their service delivery platforms inside the increasingly open sphere of (US) long distance > "backbone" operators.

Of course, most individual users are not, and will never be mobile in the same way, so the network facilities bottleneck on the individual user's end still exerts tremendous influence in determining what kinds of network architectures can and cannot work. Proof of this is provided by the long-standing (and still today only slowly eroding) concentration of "foreign" Internet resources inside the US and a few other "long haul friendly" telecom markets. Thanks to the terrific economies of packet switching and the novel directionality of international IP transit revenue flows (and much more recently, the

added miracle of DWDM), many foreign-flagged (i.e., ccTLD-named) Internet services *that are overwhelmingly intended for foreign audiences* have always been physically hosted in the US. This is because, in those markets that didn't enjoy even a US-style partial/segment-specific telecom breakthrough, Internet innovators still emerged and did their thing; they just set up one end of their service operation in the US or some other, more service-friendly environment.

The moral of the story, and the overwhelming evidence of the history of IP address distribution is:

1. IP addressing *is* (or can be) a critical bottleneck in its own right, i.e., when all of the other inputs required to deliver Internet services are freely available.
2. Preventing IP addressing from becoming a bottleneck can only provide, at best, a partial remedy to the existence of other, unrelated bottlenecks, e.g., the individual user-facing ends of the network facilities platform.
3. However, in the presence of other such bottlenecks, the absence or failure of mechanisms to protect IP addressing from becoming a competitive barrier in its own right will inevitably cause the

bottlenecks to converge and reinforce each other -- which would ultimately result in the vertical re-integration of the communications services, and the horizontal re-integration of service markets based on who controls the turf.

Savage: On the other hand, one can use a PBX (with DID) to provide telephone service to customers subtending the PBX. Again, telecom veterans will recognize this as "shared tenant services." On the other other hand, to fully compete as a peer phone company you would have an "end office switch" (not that different from a PBX) that connects to other switches using trunking protocols rather than line protocols (although again PBXs are a bit weird in this regard). And your "end office switch" would have its own set of "native" numbers assigned to it for call routing purposes.

I'm actually glad that these analogies exist. My main pitch for a spot on the ARIN Advisory Committee is that the PSTN has been through all sorts of numbering/routing problems, debates, and re-vampings over the last few decades, and perhaps my experience and familiarity with them might provide the occasional insight into some of the IP number/address issues the Internet community is now beginning to confront.

Vest I do hope that you will be selected -- the community could definitely (always) use a broader range of perspectives.

However, I also hope that you'll continue to very carefully consider these analogies too ;-)

Savage: Well, I don't want to push PSTN analogies too far, but the answer is basically "yes." On the one hand, by connecting PBXs with private lines, one can provide "routeable" long distance service.

Vest (earlier): In this scenario, who provisions, and sets prices, and defines terms of use for the private lines? You probably see what I'm getting at. If this is a valid analogy, then it leaves me puzzled: If PBX technology, which dates back to well before the 1980s, truly provided an effective, stand-alone substitute for the mix of technologies that had previously represented a competition-proof bottleneck to telecom service provision by new entrants, then why was the AT&T breakup necessary? In fact, since I believe PBX predated the establishment of the FCC, why has there ever been any support for any competition-oriented regulation at all?

Savage: Well, as I said, I don't want to push the anal-

ogy too far, and I'll spare the list a full recitation of the history of competition in the phone business. Suffice it to say that PBXs provided SOME competition to the monopoly phone company, but not a lot. And the monopoly phone company was VERY unhappy about it. In fact, the monopoly phone company would have stamped it out, but for the overriding presence of the FCC as regulator. The FCC did lots of pro-competitive things in the 1975-1985 time frame.

Vest: As I think you already know well, we are on the same page on these matters. As I've observed on this list and many other places in the past, it's impossible to discount this fact when considering the very origins and early field implementation of Internet technologies themselves. Given the fact that smart people exist all around the world, and possession of wealth and early networking technology expertise was also not absolutely concentrated among US researchers, why did it all take root here first? The timing of those early positive pro-competitive regulations (i.e., NOT simply the elimination of competition-prohibitive rules) more or less exactly matches the timeframe during which isolated universities and research institutions first made great strides toward the creation/implementation of

"overlay" communications technologies. I don't think that that can be dismissed as a mere coincidence.

Vest (earlier): Many close readers will spot the trick, but in my experience few go on to notice the even-deeper implication. Like many other industries, the communication sector is vulnerable to a variety of potentially competition-crippling bottlenecks. Historically, control of facilities/ infrastructure -- and especially the "ends" of the physical network platform -- has always been the most problematic of bottlenecks. By enabling a service provider to decouple the logical "ends" of a service from the physical ends of the network facilities substrate, TCP/IP provided an imperfect half-remedy to this bottleneck, in this sense: if either of the communicants at the two ends is not physically constrained to a specific fixed geographic point, then that mobile factor can relocate to some place where service delivery is not bottlenecked. This is probably the single most influential cause behind both (1) the early dominance of client/server architectures, and (2) the early (and still-lingering) hyper-concentration of internationally-oriented online content and services in the US. After the US was first to liberalize both "long distance" and data services, it became much

easier for Internet application and service developers to envision/implement one end of their service delivery platforms inside the increasingly open sphere of (US) long distance "backbone" operators.

Savage: In the PSTN world we sort of fixed this here in the US, to the extent we have, by virtue of direct regulatory control over what the monopolist could do, followed by court-ordered break-up of the monopolist, followed by massive legislation mandating a variety of pro-competitive things.

I'm guessing you don't think that would be a good idea for the Internet? Or would you? (I really don't know...)

Vest: I know that it's not your intention to put me to the "Are you with us or against us?" question -- but since that's been one of the most effective (and dirtiest) of responses that some of my critics have offered up in response to my views, I'll reply in some detail.

I'm not fundamentally FOR anything in particular, except the continued survival, growth, and fruitful evolution of Internet. I'm not fundamentally AGAINST anything in particular, except things that would make the above very unlikely or impossible.

My own work is not explicitly normative, and to the extent that it has normative implications, they go far beyond the issue of addressing format migration. I've posited what I claim is a strong, empirically sustained theory about what the Internet "is" at the most foundational level -- e.g., how it came to possess that key feature/functionality that makes it unique and important, how that particular feature imposes certain unavoidable structural vulnerabilities, etc., etc. What I further claim is that the isomorphism between the Internet and another implementation of the exact same functionality -- the latter of which has been carefully observed and documented through many centuries of growth, evolution, and not-infrequent collapses and recoveries -- makes my own work (very) unusually useful for predictive purposes. Lots of partial, transient "mimetic" isomorphisms have been identified by economists and policy analysts in various fields -- mostly artifacts of the application of "lessons learned" in one domain to similar problems in another -- but as far as I can tell, this is the first solid example of purely organic, naturally occurring, and durable isomorphism that has ever been identified.

So it's predictive, and having a very personal interest in seeing the Internet

survive, I can't help but make as strong a case as I can AGAINST a course of action that, history suggests, will lead to (at least one or several possible) non-survival outcomes. This is not merely (or self-evidently) a cry in vain, however. The Internet community was able to self-organize itself enough to implement an ingenious hybrid solution to the last ecological catastrophe that it faced (c. 1990-1993). Similarly, of the various non-sovereign, self-governing "banker's clubs" that defined and managed the liquidity/monetary policy mechanisms of their (late 18th-19th c.) day, many confronted and were obliged to overcome various systemic challenges that could have caused them to collapse. Although none have survived to the present day, many managed to adapt successfully and to thrive for many decades.

I wouldn't wish to see any of the four* critical features of the Internet weakened or eliminated, and so I've chosen to focus 100% of my own personal efforts on the only strategy that IMO could achieve that goal, and so obviate any need to play triage and, ultimately, sacrifice one or more in an

attempt to save the others. That strategy involves convincing the self-governing parties themselves to do (at least some of) the right things, and to not do (even one of) the fatally wrong things.

So far, I would not say that I have been entirely successful; regardless, I know of no better alternative than to keep trying.

I'll close with a corrected* version of the formulation that I gave in a response to Fred last week:

Of the four* distinct (and unprecedented, and immeasurably valuable/important) conditions that are sustained by the cur

rent hybrid system of Internet technologies and institutions -- those being (1) competitive, open, not-"fixed" markets, (2) industry self-governance, (3) transparency to most formal and informal "international" trade, investment, and communications-related barriers, and (4) it actually works -- _choose one_, or maybe two. Or if you're really, really optimistic, choose three and cross your fingers. Better make your choices soon, however, because a world without IPv6 -- or some other immediate and equally open, enabling, and functional method of Internet attachment -- is very unlikely to allow all four to exist at the same

time.

So you see, given that particular mix of goals, I'm really just doing the only thing that I can do -- that I must do.

Executive Summary

Reframing Policy by Reclassifying IP as Telecommunications pp. 1 -29

Erik Cecil sees network neutrality as an imaginary solution to the problems of telecom deregulation. Lee Selwyn in a brilliant June 2009 presentation showed the lunacy of the FCC's deregulatory infatuation. **"FCC deregulated for deregulation's sake. Confused MEANS with ENDS. No goal other than deregulation itself. No benchmark for judging success. No process for ex post evaluation of outcomes."**

Selwyn very clearly establishes how, although the extent of the natural communications provider monopoly during the period of time from Carterphone to Powell Martin shrunk, the fact that there was essentially only one point of entry for customers into increasingly closed networks created a meaningless choice between the telco or cable co. Since the FCC *also* moved all internet protocol services under the Enhanced Service Provider exemption which was unregulated, the incumbents were given the ability to rec-

reate the environment of pre 1984 monopoly services where the best the customer could hope for was a tweedle dum versus tweedle dee choice between cable co and telco – both with similar services and prices.

Erik, first in his blog and then in more detail in a *COOK Report* interview argues that that network neutrality will leave this fundamental regulatory injustice untouched. Eric finds that Network neutrality is well-intentioned manipulation of existing FCC rules. NN tries **to create common carrier rights out of an exception to common carriage. IP was regulated as an exemption to common carriage as a special case to protect it even before the 1984 breakup. The ESP exemption was originally done as a means of forcing ATT the wire owner to interconnect with IBM the device owner and to interoperate on more or less equal terms without cannibalizing IBM**

Decade after decade the interest of the network owner (the wire) has been to extract as much payment as it possible can from the device owner. As devices have gone

digital and increased by many orders of magnitude in their power and the networks have taken a short term rent extraction point of view, the device owners justly complain that the wire owners are using a system codified in 1934 to cripple their ability to contribute to the general well being of the economy.

Regulation has been an attempt to balance the competing interests of device owners against wire owners. When the devices owners at the edge create new values – the internet for example - the wire owners always seem to be able to play regulatory jujitsu to extract exorbitant value from the creativity of those who invest in improving devices while the wire owners generally invest in ways that ensure that only they extract value from the creativity of the device owner.

The original IP – ESP exemption was a policy choice to encourage competition.

But everything that counts now is IP traffic – and IP traffic is exempt from regulation. And since they own the access points for IP traffic into

and out of their networks, they have flipped regulatory ESP exemption on its head so that its continuation ensures the instantiation of the monopoly of the facilities owner in perpetuity.

Until you find a way to stop the network owner from extracting monopoly rent from its wires, you will never cross the transition chasm into the widespread productive use that Carlotta Perez speaks of as the final deployment phase of the ICT revolution. Until these technologies go into widespread use, you don't get all their economic benefits. Under wireline owner-extortion you can kiss device innovation good bye.

The wire owner is a predator. Now why would you put a private entity in control of building, constructing, and operating the wires? Your first answer is going to be its ok to do because they are regulated.

But regulators are ordinary people who are subject to the economic lobbying pressure of the wire owners.

But nothing changes because we have public officials elected with private money in charge of making sure that private ownership of public property (the right of way and the infrastructure we've funded for a century) is used in the public interest. But

Play that out over time; the private interests, by necessity, are always stronger than their public overseers.

What we can help the FCC do is articulate a vision that says – why don't we just make all this into big utility infrastructure and, if we can do that, then what we can do is get some regulatory control and leverage back to people who really need it. We want to get the states out of their hair because the Bells totally own the state Commissions.

Change needs to be anchored in statutory bedrock rather than rulemaking to get our strategic direction back to a sound direction on a national level. In order to scale and in order for cloud computing to succeed, devices need to interact uniformly with the wires no matter what state they happen to be in. You need to open up all of this uniformly by calling all of it telecommunications in your statutes. Do that and then all of it is common carriage and if it is common carriage, because it is also telecommunications, the FCC has jurisdiction to preempt state regulation because its inter state character is recognized.

The solution is for the FCC to call those IP or "net neutrality" bits telecom and thereby exempt them from state regulation. Do that as a matter of statute and, when you

are done, we can have a rule making, and in the rules you can say a network operating under common carriage must kill Spamford because any carrier is allowed to exercise reasonable control over its network.

If end-to-end is inter state and if the FCC says it is common carriage, then anyone with a device that connects to the network gets the rights of common carriage. With my device attached to the net, I don't need the carrier to sell me any service other than a big symmetrical pipe.

How Do You go about Getting IP removed from ESP and treated as Telecommunications?

Marc Cooper affirmed that this could be done and on page 15 Chris Savage listed a nine point argument that would permit it to be done

Since IP could be re-classified as telecommunications. That would help because it would make it far easier to end the regulatory gaming process by the wire owners. How to start such a ball rolling?

First: Sue the incumbents

Second; Sue the FCC. Net Neutrality will be appealed. If someone does not set this up in Comments to the FCC in the relevant proceedings

there is less of a chance of meaningful change. There will be a shootout at the DC Circuit. Those who are positioned in advance will win. Consumers, however, will most likely lose.

Third: Hold the administration's feet to the fire. Do not believe anything anyone says until you see it implemented. The road to 2009 was paved with good intentions and things said behind closed doors. If they cannot say it and embrace it in the open, it is not real.

The problem is since the regulatory process has been successfully gamed in the interest of the incumbents rather than the American people and we have an increasingly expensive and antiquated telecommunications infrastructure -

We might ask who will be the new Theodore Vail getting a legal monopoly and antitrust immunity for rate of return regulation of a gold-plated infrastructure? Promises of a gigabit to every home...

Why not Google?

Here's their deal for the customers: free telephony, free broadband, non discriminatory access to the world's knowledge in return for rate of return regulation.....(And the freedom to make money

out of ad streams as well). All that is needed is to submit to being a regulated utility, allow the consequences to undermine the value of the competition, buy the underlying communications infrastructure for a song (but safeguard the pension rights to ensure political credibility). . .manage congestion and secure free speech... Where's the downside?

Regarding dark fiber networks, *the real point there is not so much that Google has one as it is that there is NO LOOP and NO BACKBONE. There is just network. Where consumers and individuals are getting screwed badly is that we continue to fund loop providers NOT to DEPLOY advanced equipment - wide open fiber optic.*

The asymmetrical regulatory system that they control won't allow this to change because the basic business models for the incumbents are still predicated on economically milking their control over access to the network by all of us since this is the one place where they still enjoy a monopoly. Their rates, taxes, and subsidies are all based on the costs of the copper based "local loop," over which, as Selwyn has shown, is the only thing that they still have complete control.

While the heart of the network is predicated on energy efficient and transport unlimited fiber, they have used regulation to take over and turn the system inside out that at one point was used to protect the interests of their customers. While they may want to be in Google's business, they are holding on for dear life through a regulatory system fractured amongst 50 state PUCs to a business model predicated on scarcity and charging for every unit of "service."

As Erik Cecil concludes the problem, ultimately is not lack of regulation but the asymmetrical ESP regulatory exemption that was originally done to keep the incumbents from killing internet protocol based packet switching. However, with the incumbents using the alleged competitive nature of IP services as a means to gain removal of their common carriage obligations from the last vestige of their remaining monopoly - the local loop - because internet as an enhanced service is still alleged to be competitive. The only problem is that they now control every entryway into that unregulated "enhanced services" space and so are free to do what ever they like to anyone wishing to compete.

Symmetrical Megabit per Second Wireless to Mt Everest, pp. 30-45

We interview Pavan Shakya who in partnership with Pemba Sherpa of Namche Bazar and WordLink has a Canopy radio based wireless link from WorldLink in Kathmandu in three hops to a ridge top known as Rautah at 6,500 feet and from there 98 kilometers to the Everest View Hotel at Syangboche airstrip at 13,500 feet overlooking Namche Bazaar. Benefitting from a connection to fiber made by the Nepal electric authority at the Indian border and running to Kathmandu they are bringing symmetrical one megabit per second bandwidth for \$700 a month as opposed to \$1300 for 384 by 256 kbs Vsat bandwidth.

Using a total of 20 photographs and maps we explain the topology of the network and examine its uses which range from communications support for sherpas and trekkers to climate change research.

IP v4 Exhaustion what is at stake – pp. 46 -63

With 90% of Ipv4 block now assigned by the routing registries we had another long discussion. of possible work

arounds as well as of the issue of what markets for reassignment of IPv4 addresses would look like.

Variable outcomes seem to be how many new users can be accommodated by increased use of Network address translation and whether the development of a market for IPv4 addresses would be able to use monetary incentives to free up enough unused IPv4 addresses to supply the needs of new entities wanting to supply internet service. It was pointed out that such addresses would need to be routed to be worth anything.

The existence of IPv4 addressing as Tom Vest points out serves as a unit of currency that enables a new business to get and use the ASN number necessary to use the internet as an ecosystem. No matter what technology a new entrant has and no matter how attractive its business plan, without an ASZN number and routable IPv4 bloc or blocs and new business may not participate in the internet ecosystem.

Tom puts the problem this way: During the period between (a) the exhaustion of the unallocated IPv4 pool and (b) the day when possession of IPv4 ceases to be an absolute prerequisite for enjoying "autonomous" status as a provider of routing or other

Internet-based services, the prospect "competitive entry" will cease to exist in all countries -- or at least, in all countries that are enmeshed in what we call "the Internet" today. New entrants may continue to emerge during that period, but each new entry will be contingent on securing the permission of incumbent services providers (and also, implicitly, of competing speculators or "market makers"), in the form of an "IPv4 transfer" of some kind. My guess is that "fee simple" IPv4 transfers -- the only kind which would provide the same degree of commercial freedom of action that incumbent IPv4 recipients have always enjoyed -- will be both very expensive and rare.

Later Chris Savage asked and Tom Vest replied:

Savage: I'm not making any predictions here about how "the market" for addresses would work out, but the fact that different businesses with different applications will obtain differential benefits from IPv4 addresses, being behind a NAT, and IPv6 addresses suggests that some kind of trade/market mechanism could actually improve things, in the absence of some Levathan directing everyone to move to IPv6 or imposing binding rules on the sharing/reallocation of remaining IPv4 addresses.

Am I missing something?

Vest: If you are, it's only a full appreciation of how amazing and improbable is the thing that we're about to give up. This is only the second time in human history that a completely novel liquidity mechanism has emerged out of the spontaneous interaction of independent economic agents. It represents a model of how liquidity systems can and **should** work under conditions of "abundance," e.g., in a world dominated by nonrival real factors. The fact that it has spawned such a vast, diverse, and thriving/innovative economy in the **absence** of a pervasive/continuous monetary payment mechanism represents a direct challenge to the world views of many of the more reductionist schools of economic thought -- and this is one of the reasons why this particular view induces such an angry reaction in some quarters. Consciously or unconsciously, the reductionists recognize it for what it is: a description of a world in which their entire understanding of what motivates people, and how economies work, has been falsified (or at least de-universalized).

And later Tom concludes

I'm not fundamentally FOR anything in particular, except the continued survival,

growth, and fruitful evolution of Internet. I'm not fundamentally AGAINST anything in particular, except things that would make the above very unlikely or impossible.

My own work is not explicitly normative, and to the extent that it has normative implications, they go far beyond the issue of addressing format migration. I've posited what I claim is a strong, empirically sustained theory about what the Internet "is" at the most foundational level -- e.g., how it came to possess that key feature/functionality that makes it unique and important, how that particular feature imposes certain unavoidable structural vulnerabilities, etc., etc. What I further claim is that the isomorphism between the Internet and another implementation of the exact same functionality -- the latter of which has been carefully observed and documented through many centuries of growth, evolution, and not-infrequent collapses and recoveries -- makes my own work (very) unusually useful for predictive purposes. Lots of partial, transient "mimetic" isomorphisms have been identified by economists and policy analysts in various fields -- mostly artifacts of the application of "lessons learned" in one domain to similar problems in another -- but as far as I can tell, this is the first solid example of purely or-

ganic, naturally occurring, and durable isomorphism that has ever been identified. For what Tom is talking about see the detailed report on his exposition of IPv4 addresses units that are isomorphic to units of currency within the banking system of all modern economic systems in the December 2008 **Cook Report**.

So it's predictive, and having a very personal interest in seeing the Internet survive, I can't help but make as strong a case as I can AGAINST a course of action that, history suggests, will lead to (at least one or several possible) non-survival outcomes. This is not merely (or self-evidently) a cry in vain, however. The Internet community was able to self-organize itself enough to implement an ingenious hybrid solution to the last ecological catastrophe that it faced (c. 1990-1993). Similarly, of the various non-sovereign, self-governing "banker's clubs" that defined and managed the liquidity/monetary policy mechanisms of their (late 18th-19th c.) day, many confronted and were obliged to overcome various systemic challenges that could have caused them to collapse. Although none have survived to the present day, many managed to adapt successfully and to thrive for many decades.

I wouldn't wish to see any of

the four* critical features of the Internet weakened or eliminated, and so I've chosen to focus 100% of my own personal efforts on the only strategy that IMO could achieve that goal, and so obviate any need to play triage and, ultimately, sacrifice one or more in an attempt to save the others. That strategy involves convincing the self-governing parties themselves to do (at least some of) the right things, and to not do (even one of) the fatally wrong things.

So far, I would not say that I have been entirely successful; regardless, I know of no better alternative than to keep trying.

I'll close with a corrected* version of the formulation that I gave in a response to Fred last week:

Of the four* distinct (and unprecedented, and immeasurably valuable/important) conditions that are sustained by the current hybrid system of Internet technologies and institutions -- those being (1) competitive, open, not-"fixed" markets, (2) industry self-governance, (3) transparency to most formal and informal "international" trade, investment, and communications-related barriers, and (4) it actually works -- _choose one_, or maybe two. Or if you're

really, really optimistic, choose three and cross your fingers. Better make your choices soon, however, because a world without IPv6 -- or some other immediate and equally open, enabling, and functional method of Internet attachment -- is very unlikely to allow all four to exist at the same time.

So you see, given that particular mix of goals, I'm really just doing the only thing that I can do -- that I must do.

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A Note from the Editor on the December 2009 Format and Presentation

This issue begins with an interview with Erik Cecil on the need to rationalize telecom policy by convincing or forcing the FCC to end the ESP exemption for IP. This is an unannounced bonus that grew out of the list discussion. We also include the promised interview with Pavan Shakya on megabit per second wireless kathmandu to Everest.

Coming in the January 2010 issue - out by or before December 5, Tim Cowen on his construction of a more unified approach to government IT expenditures in the context of open standards and cloud computing. Tim Cowen's economic goals are highly significant in the on going context of attempting to build a more rational economic approach toward telecom investment. An interview with Rod Hall, Analyst at JP Morgan on Alcatel Lucent still likely.

I am attending Supercomputing 09 in Portland November 14-19 and Supernova December 1-3 in San Francisco. I expect to interview Cees de Laat and Kees Neggers again and publish a report on their activity in the February 2010 issue.

Text, URLs and Executive Summary: I have attempted to identify especially noteworthy text by means of boldface for REALLY good "stuff" . Also the proper Executive Summary in this issue continues. I hope you find it useful. Feedback welcomed. You will also find live URL links and page links in this issue.. (I am also no longer changing British spellings of things like fibre to the American fiber.) Thanks to Sara Wedeman - see www.becgllc.com for assistance with the masthead logo. Captain Cook now charts direction by looking at a compass rosette.

I am omitting the contributors' page since a cumulative list may now be found at http://www.cookreport.com/index.php?option=com_content&view=article&id=121&Itemid=74