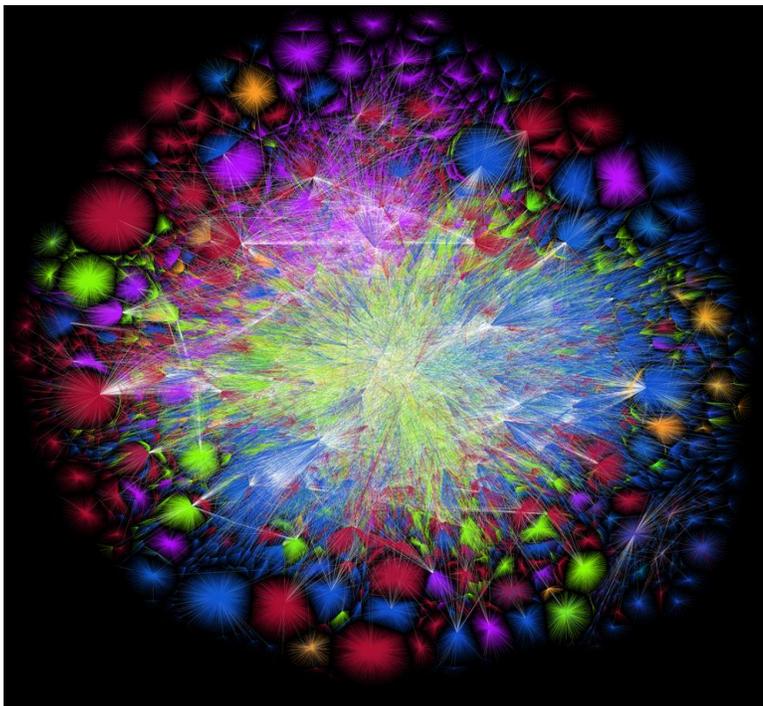


Area Codes Are
becoming Obsolete?



TRENDING
TOWARDS A
PURE
INTERNET

Essay by Ian Lenathen

CANTO Emerging Technologies Committee

About the Author:

Ian Lenathen is a technology trend analyst with deep and wide experience in the Telephone, Internet and Computer industries.

Starting his career as a logic design engineer, working with super scale computer architectures developed by Seymour Cray, he moved on to NorTel Networks and Bell Northern Research as an expert on DMS hardware and software architectures. Ian then took senior level positions in International Marketing and Sales, leading the strategy for digital switching sales into emerging markets.

As Managing Director of Internet Associates International, he enabled over 15 million people in the Caribbean to connect to the Internet. He was the network design and deployment lead contractor, bringing Antigua and Barbuda, Anguilla, Aruba, Jamaica, Dominican Republic, Bahamas, Dominica, St. Lucia and Turks and Caicos Islands on-line.

Ian is now President of Ian Lenathen Associates Inc. working as a Business Development consultant with the objective of bringing a new competitive business model to both AC-ISP's and PI-ISP's, and also provide advocate consulting services to Telecom Regulators and Telecom Government Ministers in the region. Towards this end, Ian is currently ready to deploy the first PI-ISP in the region.

2 CONTENTS

3	Introduction	2
4	The Computing Speed and Capacity Road Map.....	6
5	The Transition from a Voice Centric Network to a Data Centric Network	7
6	Advantages of Pure Internet versus the AC-ISP model.....	8
7	Mobile Digital Advertising: the drive that will survive.....	9

3 INTRODUCTION

This essay explores how the old telephone network has turned into a modern computer network, where time, distance and area code fiefdoms become irrelevant in the movement of information.

Everything is digital!

The traditional old POTS telephone network is not the telephone network anymore.

The telephone network instrument is not a telephone anymore.

Advancements in solid state physics are following Moore's Law.

Fiber optic technology advancements are moving faster than Moore's Law.

Communication connections are growing exponentially and the value of the network is growing at $n \log(n)$ where the number of connections increase the value of the network by $\{\log(\text{the number of connections})\}$.

- Public Internet platforms are ubiquitous
 - OTT (voice, video, SMS, location and presence)
 - Web
 - Social Networks
- Private Internet platforms are ubiquitous
- Internet eXchange Points (IXP's) are common
- Internet Protocol Exchanges (IPX's) are common in the Private IP address domains of Area Code ISP's
- Pulled then pushed adware is ubiquitous – user relevant e-advertisements generate the revenues for the OTT content and application providers

Standard Computer network protocols like TCP/IP/SIP are ubiquitous.

- **Area codes are not required for text, voice, presence and video sessions**
- **Area codes are becoming obsolete**

Definitions to know:

The world's communications networks can be defined by two terms – those networks which use area code fiefdoms and those that use pure internet protocols – with no area codes required:

- **AC-ISP** –
 - 1. A telephone company

- 2. A cable company having assigned Area Codes for fixed or mobile telephony operations
- **PI-ISP** – A content and application carrier using pure internet (TCP/IP and SIP) protocols end-to-end for all internet connected users.

The Area Code Internet Service Providers (AC-ISP's) have enjoyed a technology and platform architecture monopoly around the world, working through the International Telecommunications Union (ITU), most recently, setting LTE roadmaps, for all vendors.

The ongoing work of 3GPP, 4GPP, and the future xGPP discussion groups, manage and control the state of the technology to be used by the AC-ISP's around the globe.

This strategy, along with the control and integration of "smart phone" deployment, has produced brilliant results. Any outside observer would think AC-ISP's, with the next big thing marketing cohesion of the device providers (Apple, Samsung etc.) surely own the future of the internet.

- **They don't.**

Innovation is a pressure cooker. The pressure is released through disruption of the status quo.

Innovation is change in motion. Status quo is change in slow motion.

When looked at closely, it becomes apparent, area coded boundaries are archaic; not necessary at all, except in the charging of customers as false metrics applied to the "roaming" of packets.

- **Packet roaming is design intent!**
- **Area codes are used as packet anchors, as if a packet has to have a home domicile**

OTT and pure internet applications are capable of usurping the power of the technology monopoly, from the world's AC-ISP's, deploying a pure TCP/IP architecture more efficient and less complicated and thus totally disruptive to the area code model.

We are moving away from the Area Code model, and by "we" I mean the users.

Pure Internet – Internet Service Providers (PI-ISP's) are already competing with the AC-ISP's, and the AC-ISP's are crying foul, since these OTT companies do not need to follow the rules and regulations, as the AC-ISP's must do.

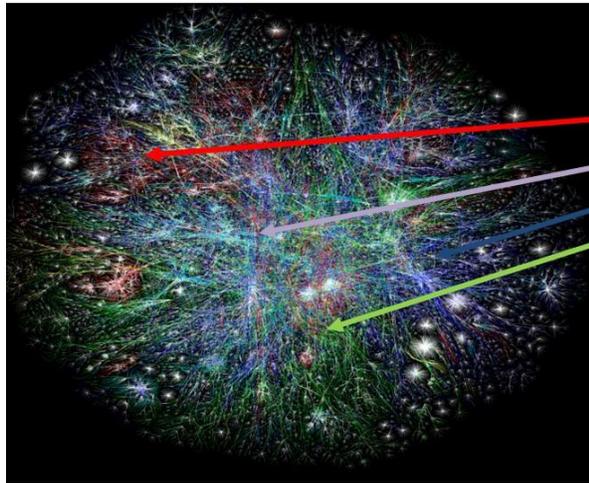
Area Code ISP's need to be aware, a flatter and more efficient network is ready to blossom providing real competition to the status quo network operators. There is no prejudice in writing this paper. It is written to expose the trend analysis moving from the old style highly hierarchical area code delimited network to a flat content and application driven pure internet.

AC-ISP's could easily become PI-ISP's but they probably won't, due to the status quo-ness of their marketing and operations traditions.

Their tardiness to change is a withering of usefulness.

The next three pictures show the growth of the internet from the end of 2003 to the middle of 2015.

Note these Internet Maps represent the growth of the internet IP address connections at the Tier 1 to Tier 3 levels, and therefore represent the growth of the Pure Internet on the planet, over the past 13 years.



**The Internet Map
Nov. 22 - 2003**

Asia Pacific
CALA
North America
Europe

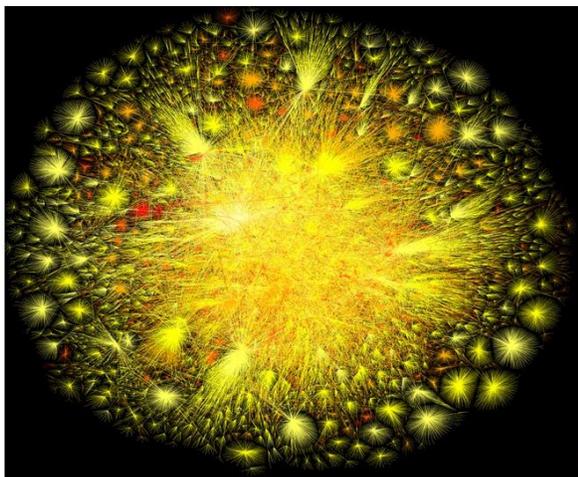
Pure
Internet
End-To-End

Created by www.opte.org

It is truly an amazing feat of communications access and transport engineering and the AC-ISP's have been key partners in this magnificent build.

Companies like Google, fb, Amazon and more, are pure internet players and they have the means to change the game and basically, render the AC-ISP's obsolete.

As can be seen from these internet maps, the growth of the backbone, mostly fiber, is significant. These connectivity paths have been built by private and public Undersea and Terrestrial "cable" companies which are mostly in the wholesale business of being the "carriers for the Carriers".



**The Internet Map
Nov 22 - 2010**

Pure
Internet
End-To-End

Created by www.opte.org

Take a minute to look at the three internet maps included here, and you should realize there is an opportunity to change the game and use the AC-ISP's biggest asset (Area code control over specific countries and regions) as its greatest weakness.

If indeed, area codes are becoming obsolete, then the

companies holding on to them, and controlling the users in their area code areas, are also becoming obsolete.

Status quo thinking eventually becomes the greatest vulnerability to take advantage of, when competing with incumbent and previously almost impenetrable status quo companies.

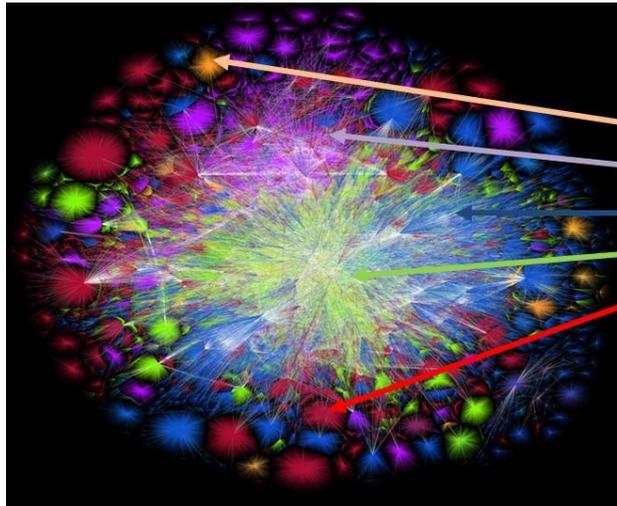
Innovation forces old school strengths, to be irrelevant in new school thinking.

The AC-ISP's recognize they need more control over telephony and data communications, and technologies like Wi-Fi and LTE-U coexistence, where the AC-ISP is able to use LTE within the unlicensed (where the U comes from) spectrum dedicated years ago to Wi-Fi access.

VoLTE is also a method to keep the control of telephony and data communications under the authority of AC-ISP's, allowing them to invoke area code billing metrics – where area codes are not being used (even by the AC-ISP's in an LTE end to end call).

ISDN User Part (ISUP) ensures packet routing and content remains under control of the AC-ISP carriers.

Invading the traditional unlicensed spectrum space set aside for Wi-Fi enables the eventual elimination of the human benefits Wi-Fi has provided since its first use in 1997. Indeed, both LTE-U and VoLTE, are



The Internet Map July - 2015

Africa (AFRNIC)
CALA (LACNIC)
North America (ARIN)
Europe (RIPE)
Asia Pacific (APNIC)

Pure
Internet
End-To-End

Created by www.opte.org

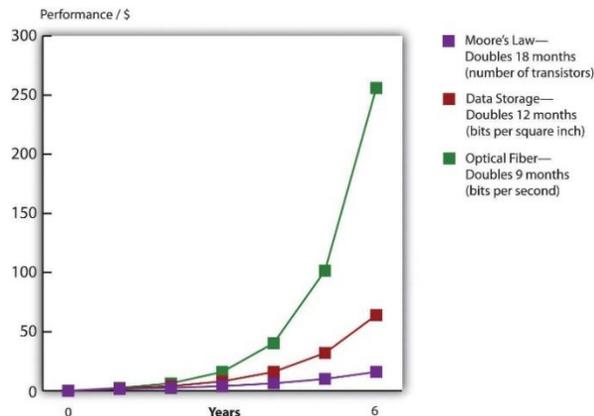
technologies which ensure the technology monopoly grip, of the AC-ISP's.

With these technologies in place, and with the locked in Area Codes, Country Codes and City Code domains belonging to the various global AC-ISP's, they will, in fact own the internet.

So the take-away from this introductory section, which support the trend wards the emergence of a Pure Internet architecture is:

- Everything is digital
- Advances in solid state physics are moving as per Moore's Law
- Pure Internet IP address map (3 shown) is expanding approximately as per Moore's Law
- The value of the internet is increasing at approximately, $\{\text{Log}(\text{number of IP address})\}$
- AC-ISP corporations are aggregating to monopolize wholesale capacity and retail telecom bundles under one strategic plan.
- Technology protocol extensions like LTE-U and VoLTE will be used to constrict competition, by increasing the reach and control of voice and data access. (Call path control through VoLTE – Content control through ISDN User Part (ISUP)).
- The Area Code routing hierarchy is the greatest vulnerability for global AC-ISP's

4 THE COMPUTING SPEED AND CAPACITY ROAD MAP



- **Moore's Law – The number of transistors (gates) on a chip doubles every 18 months and the cost per gate of fabric real estate over that period will decrease by one half.**
- **The internet cost and capacity basically follows Moore's Law.**

Innovation is driven by the miniaturization of solid state device circuits and electron paths, where at this point in Moore Law time, the iPhone 6 is able to contain more than 6 billion transistors, within a very small package.

So, applying Moore's Law, within eighteen months, over 13 billion transistors will be built on the same wafer real estate as is currently used, in the iPhone 6.

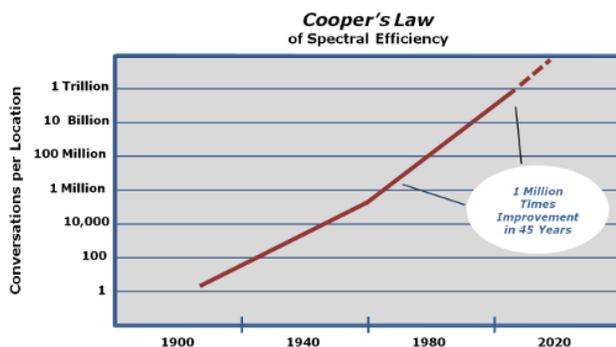
The greatest innovation has been in the miniaturization of components and circuit paths within the field of solid state physics. The old 1945 Von Neumann architecture is still the same today as it was back then, though we have added parallelism and virtualization abstracts to the mix.

The miniaturization of elements, in the science of solid state physics, is the enforcing principle behind Moore's Law.

Getting **physically and cost-wise smaller, yet capacity and speed-wise taller**, is the nature of the science. This is the soul of computer technology, and Moore's Law is still on track over the physical aspects, enabling us to deliver more value through greater capacity, at about half the cost every 18 months.

Some say Moore's Law cannot go on much longer since the paths are becoming so small, quantum effects are occurring. I think the acceleration will increase as we discover more about how to build a computing platform based on quantum physics, where the torch of progress will be passed from the solid state physics arena, into the quantum state physics arena. Intuitively, the trend must continue.

Moore's Law is not the only force enabling innovation.



- Optical Fiber bits per second is doubling every 9 months
- Data Storage bits per square inch (2.5cm²) doubles every 12 months

Wireless spectral efficiency, in spite of the Shannon-Hartley theorem, is surprising us as we get more capacity into the LTE roadmap following the path of Cooper's Law to the point where we have engineered over a one million times improvement in spectral efficiency over the past 45 years. One of

the enablers of this efficiency is the increase in the channel size used. As we increase computing power, we increase the data capacity and speed within the larger channel space.

Eventually we will have to use parallelism since spectrum in a wireless network is finite;

Spectrum in a light network though is infinite – so we can imagine where this one is going.

The Shannon Limit will be a barrier to Single Mode Fiber technologies, but Space Division Multiplexing (SDM) breaks the Shannon Limit (theoretically and moving towards reality).

The take-away here is:

- In computing, storage, wireless and fiber technologies, our research and design engineers/scientists continue to expand our resources at less cost per bit
- The utility of the entire network has no bottleneck (yet)
- All technologies required in the mix are becoming physically and cost-wise smaller while also becoming capacity and speed-wise taller.
- Innovation is the mother of eventual necessity... when a limit is hit due to the exhausted technology gains (Shannon Limit e.g.) of a status quo technology, a new technology appears and leaps past the limit (SDM e.g.).

5 THE TRANSITION FROM A VOICE CENTRIC NETWORK TO A DATA CENTRIC NETWORK

Akamai shows the growth of data over voice in the network in the chart

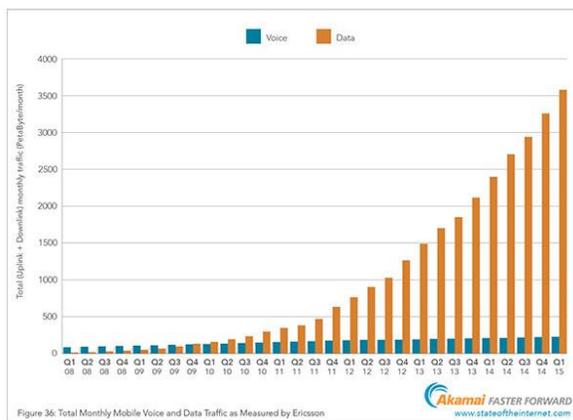


Chart shows Voice and Data Growth 2001 to 2015

- Q4 2009 Voice and Data were about even – Data now exponential with no end in sight
- Greater capacity exponentially increases the opportunity to deliver greater value.

The telephone network has become a data network and it is following the computer innovation road map.

The internet uses herds of routers and servers, located in server farms around the world, connected

in “meet me” areas (Internet eXchange Points – IXP’s) where undersea and terrestrial, fiber and copper pipes meet and cross-connect, multiplexing and sharing channelized conduits... delivering data, video, messaging and voice communications between people and machines around the world.

As shown by the chart from Akamai above, the mobile “phone” network is actually a mobile data network. The amount of data growth is not unexpectedly following the same curve as Moore’s Law.

Data transverses a packet switch network, and to a packet switch network, a packet containing digital voice, is just another data packet.

No special area codes are required. The source and destination addresses are contained within the packet. We have Quality of Service idioms

There is a continuous merging of products and purposes, fueled by wholesale capacity providers, Area Code ISP’s (AC-ISP’s), Pure Internet Over The TOP Application Providers, Pure Internet ISP’s (PI-ISP’s) and various retail multiple service providers.

The world network layers are changing from the old area code defined territories protected and money mined by telephone and cable companies to the new Internet Protocol (IP) companies which use the Top Level Domain names in a world defined layer of country codes (.tc, .us, .ca etc) and domain name extensions like .com, .gov, .org etc}.

The take-away here is:

- In about 2009, the telephone networks of the world carried more data traffic than voice traffic and the data traffic has grown exponentially ever since – the phone network is a data network
- Since modern data networks employ mostly TCP IP protocols for global end to end communications, area codes are not required
- The growth of IP addresses (as shown in the Internet Maps) indicates TCP IP traffic is growing exponentially as compared to Area Code traffic
- Area codes are becoming less relevant year over year

6 ADVANTAGES OF PURE INTERNET VERSUS THE AC-ISP MODEL

Competition between AC-ISP's is fierce, yet the competition is not about technology differences; it is about data plans and voice plans – it is a marketing war, rather than a technical capabilities war.

Apple took full advantage of this in the early and middle days of the iPhone version releases, done with great fanfare, as customers lined up for days in front of the electronic big box stores, making sure they were one of the first to have the new device.

Apple told the big AC-ISP's like Verizon and Sprint what the price points would be and the big AC-ISP were not making too much profit on the devices. The big AC-ISP's begged in some cases, the Apple product managers to include their LTE and HSDPA spectrum in the product release.

Customers would jump to a competitive Carrier if the latest iPhone version was not available on the one they were signed up with. The shiny beautiful device maker was playing the tune the AC-ISP's had to pay for the piper.

As time goes on, as is being seen in the market, the devices eventually become a commodity and other manufacturers like Samsung – catch up and offer the same or better features – to a less fickle, and more savvy purchaser.

The network though is not a commodity; it is the engine of innovation, and Samsung lining up with Google using the Android operating system, provides beneficial synergies which just work better together with some of the network applications.

The question is, will future profits come from the user centric hand held devices – being commoditized more and more as time goes on, or from the cloud architected OTT services and applications – all software defined?

The AC-ISP's receive their innovation and basic technology monopoly road maps, from the ITU, under the various 3GPP, 4GPP and 5GPP working groups, which basically provides the entire AC-ISP community with a standard road map, enabling the technology monopoly to continue. The working groups of the ITU try to ensure the AC-ISP's by incumbent tradition, own the future development of the internet.

There really is no technology difference. Each of the AC-ISP's use the same 3GPP or 4GPP technology road maps, purchased from favorite vendors who have worked with them for many years. Each of the vendors also follow the road maps.

This approach does have a vulnerability though, almost like a Trojan horse, galloping through the AC-ISP marketing strategists plan.

The Trojan horse is TCP/IP and recently SIP protocols.

These are the ubiquitous and layer one to layer 3 established rules of the internet (SIP does run up on layer 6).

All of the pure internet companies like Google, fb, Microsoft etc. use TCP/IP and, using the same transport and access technologies of the AC-ISP's, they can build a network based on the pure internet building blocks, streaming data packets to and fro, totally ignoring the area codes which are the anchors and fiefdoms of the telephony and cable companies throughout the world.

7 MOBILE DIGITAL ADVERTISING: THE DRIVE THAT WILL SURVIVE

The pure internet companies use digital advertising as their major source of revenue, as can be seen from recent market movements.

According to Advertising Age, Google had revenues of about \$22 Billion last year and about \$19.1 billion of that came from delivering digital ads to consumers on multiple platforms. This was a result of Google eyes clicking 31% more on ads, increasing ad revenue by over 17% in 2015.

Large AC-ISP's like Verizon are astute enough to know where this market is going, and did purchase AOL in 2015 to gain a foothold in the business model being so successfully executed, by both Facebook and Google, while its traditional AC-ISP business started to decline. The purchase of AOL was not made to gain the subscriber base; it was made to gain the impressive AOL digital advertisement platform.

In July 2016, Verizon struck again and purchased the best parts of Yahoo, spending another \$4.8 Billion (added to the \$4.2 Billion spent in 2015 for AOL, for a total of about \$9 Billion) to strengthen its stake in the digital ad business where advertising, while delivering home grown and third party content, is the driving formula for business growth and survival, as more services and applications are delivered on the pure IP internet. Verizon knows, future revenues will include the advertising business model.

On the other side of the competitive arena, Google is moving to compete with the likes of Verizon and AT&T in the internet business services segment.

Google Fiber (one of the Google Alphabet companies) is starting to sell internet service to businesses over a PI-ISP architecture. Google started trialing and learning about the rollout of business services back in 2014, starting with Kansas City. In July 2016, Google officially opened for business in Charlotte NC, and will continue to roll it out in the other "Fiber Cities" Google has built or acquired. The fiber backbones and access business plan is quite simple and is based on paying for access to the pipe, where OTT services are encouraged. Businesses are offered three price options; 100Mbs - \$70 per month; 250Mbs - \$100 per month and 1Gbs - \$250 per month.

Google has also launched Project Fi, in over 30 countries. This project also helps the sales of Google's Nexus phones. The Project Fi SIM card is sent in the mail, you place it into your phone, and after following a few simple screen commands - voila! - you are on the network. The data consumption fee structure for this is also flat and easy: \$20 per month for basic service - plus \$10 per month for every Gig of data you use. Simple, easy - no surprises - no complicated data plans - no roaming fees - and no area codes to worry about. Oh... and please use all of the OTT services you like - OTT is encouraged, and why not?

It is no accident, Microsoft bought Skype last year and has now launched an improved version, known as “Skype for Business”. Subscribers pay about \$40 per month to integrate Skype for Business with the cloud version of Office 2016, which provides a rich suite of applications and services, over peer to peer connections which includes excellent video conferencing world wide (without an area code, or a Roaming Fee in sight). This is just one of many compelling end user communications solutions which will launch from Google, Facebook, Microsoft and a myriad of innovation driven third party start-ups in all verticals.

Facebook just launched a solar powered plane seeking a new method to bring broadband access to the next one billion. Microsoft is bringing an access model using the white space available in television transmission spectrum to bring broadband to the next one billion ... neither of these efforts involve area codes.

The take away here for the companies of CANTO is, area code domains and the status quo business models are becoming obsolete. New business models must be explored to ensure future growth and competitive relevance.

The Country Code/Area Code/City Code/Office Code hierarchy owned and controlled like fiefdoms by AC-ISP's managed by the ITU, are irrelevant and not really needed at all, to provide all and any communication applications over the internet. The irrelevance is flowing as a widening exponential relationship, between over the top applications, and those based on Area Codes - and the fiefdoms they define.

Time to innovate new business models, including those based on PI-ISP metrics.