
Convergence in Telecom Networks

Is there **a** future?

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Topics

- ◆ a caution - mantra or reason
- ◆ a worry - architectural differences
- ◆ a plan - network convergence where it makes sense
- ◆ what is the IETF
- ◆ IETF technology directions
- ◆ predictions

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A Note

- ◆ I'm coming from an Internet background
- ◆ I will overstate the issues in some places to make sure they are clear
 - note: even my overstated views understate the views of many Internet people

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A Caution

- ◆ too many people search for simple answers to hard questions
- ◆ very popular with technology pundits
- ◆ 100 years of telephone technology and architecture will not be discarded
- ◆ 25 years of Internet technology and architecture will not be discarded
- ◆ where do the business models fit?

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Context: Convergence as Mantra

- ◆ is IP today' s ATM?
 - ATM was the answer, what was your question?
 - was going to converge the world
 - note that ATM is no longer *the* answer
- ◆ is convergence a mantra or a direction?
 - or both
- ◆ is MPLS the IETF' s ATM?
 - with variable length cells
- ◆ i.e. thinking is good for you

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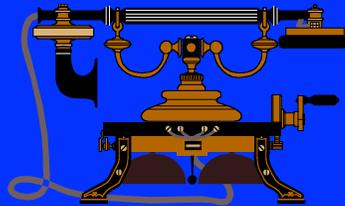
A Worry: Architecture

- ◆ one big issue in telco/Internet convergence are the architectural assumptions in each camp
- ◆ Internet:
 - stupid network
 - smart edges
 - applications on 3rd party servers or in end nodes
- ◆ teleco network
 - smart network (Intelligent Network - IN)
 - dumb edges
 - applications in service provider network

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Traditional Phone Network

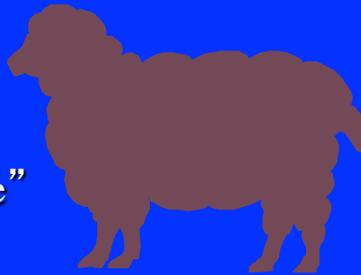
- ◆ circuits
- ◆ connection-oriented
- ◆ hard state in network devices
- ◆ central resource control
- ◆ socialist? "for the good of all"
- ◆ applications in network
 - e.g., phone switch
 - end-to-end touch-tone signaling was a mistake
- ◆ predictable development path
 - extended development cycle



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Internet

- ◆ datagrams
- ◆ soft state in network devices
- ◆ competitive resource control
- ◆ capitalist? "individual initiative"
 - but too much selfishness hurts all
 - must play by the same rules - but no enforcement
 - the tragedy of the commons**
- ◆ applications in hosts at edges (end-to-end)
- ◆ hard to predict developments
 - chaos at "Internet time"



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Implications of Packet-Based Networks

- ◆ paths through network are not stable
 - they change based on
 - link failure, traffic engineering, routing instability,
 - link utilization (someday)
- ◆ impacts QoS
 - hard to reserve resources
 - unpredictable QoS
- ◆ access control harder
 - e.g. tracking down DoS attacks
- ◆ little central control

!QoS

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Implications of end-to-end Model

- ◆ things in the path get in the way
 - if they need to know about sessions
- ◆ e.g. firewalls, gateways, caches
 - e.g. WAP
- ◆ need to be able to experiment with new applications without getting permission from carrier

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Internet Service Architecture

- ◆ service provided by 3rd parties - not only by ISPs
- ◆ different from phone world
- ◆ a quote from Sunday, 16 Apr 2000 11:10:57

Hi Roy,

I still don't understand why it is a "users" choice where the "services" are executed - I would have thought that this would be networks choice - and the means for doing that is what we are now discussing. Can you please clarify why a user "MAY" which to decided this.

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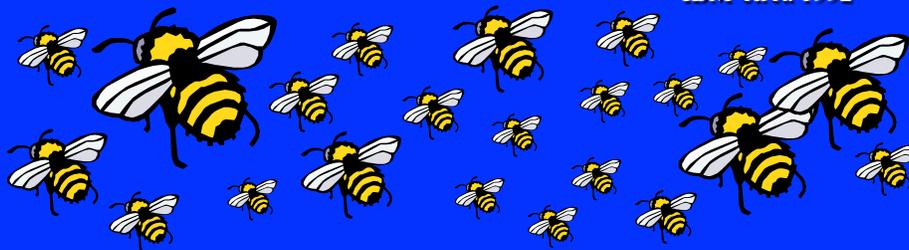
Conceptualization Problem

- ◆ fundamental disconnect between "Internet" and "phone" people "bell-heads vs. net-heads"
- ◆ by some definitions the Internet can not work and must be fixed



"You can not build corporate network out of TCP/IP."

IBM circa 1992



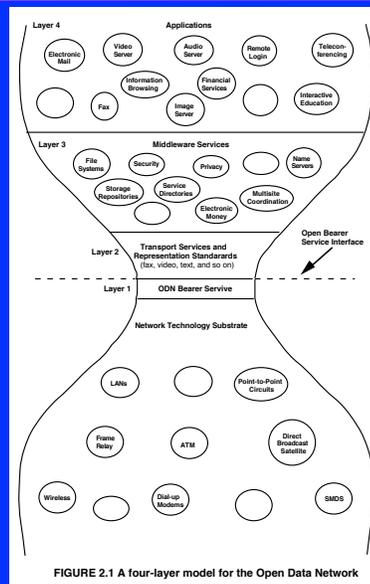
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Real-Life Lesson

- ◆ remember cell-phones
- ◆ once dismissed as too poor a quality for any businessperson to use
- ◆ need to take into account all aspects
 - QoS does not rule in all cases
 - convenience, cost, features

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IP as a Common Bearer Service



From: Realizing the Information Future

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IP as Bearer Service

- ◆ network does not need to know application
- ◆ application does not need to know network
- ◆ do not need to change network to support a particular application
 - even voice
- ◆ may be useful to add general use features
 - e.g. security or QoS controls
 - but not for a specific application

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Internet Features

- ◆ you do it
- ◆ you don't need permission
- ◆ you don't have to wait for them
 - who ever "them" is
- ◆ that means the Net is unpredictable
 - a worry to government types
 - dynamism vs. stasis
 - the strength of the Internet is chaos

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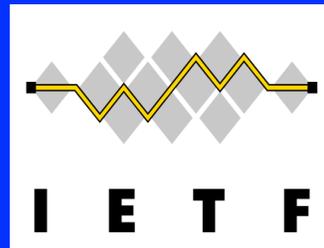
A Plan

- ◆ add additional basic functionality to Internet
 - sub-IP provisioning and traffic engineering
 - QoS,
 - security
 - routing
 - reliable transport
 - unreliable transport**note! - but no session-state in Net**
- ◆ develop application support technologies that use these new functions

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What is the IETF?

- ◆ an engineering organization
- ◆ a group of people who solve Internet problems
- ◆ but it does not legally exist



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The IETF

- ◆ Internet Engineering Task Force
- ◆ formed 1986
- ◆ other standards groups cooperate with, imitate or fear the IETF (but some still ignore it)
- ◆ not important enough for a long time - good!!
getting more attention these days
- ◆ not government approved - great!!
- ◆ people not companies

“rough consensus and running code”

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An Engineering Organization

- ◆ vendors
 - ◆ users
 - ◆ network operators
 - ◆ academics
 - ◆ researchers
 - ◆ all as individuals
 - ◆ no membership - thus no voting
 - ◆ supported by meeting fees
- ISOC supports some functions e.g., RFC Editor

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Scale

- ◆ 300 in 1990
- ◆ 2400 attendees in Washington DC
- ◆ 1400 attendees in Adelaide, Australia
- ◆ unknown number on mailing lists
- ◆ from 100s of companies
 - biggest industry sector in the last few meetings: telephony

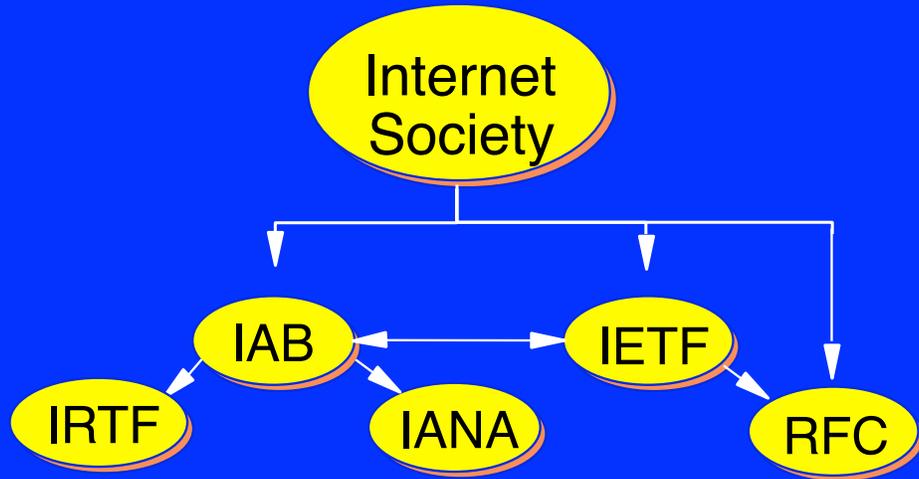
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IETF Big Topics

- ◆ security - IPsec, TLS, Kerberos, smime
- ◆ QoS - intserv, RSVP, diffserv
- ◆ routing - MPLS, BGP, SSM
- ◆ internet - IPv6, IP over foo, DHCP, iDN, svrloc, mobile IP
- ◆ telephony - SIP, megago, SCTP, enum, rohc, pint
- ◆ applications - HTTP, LDAP, web caching, calendar
- ◆ management - SNMP, policy, AAA, RADUS
- ◆ transport - rmt, tcpsat,

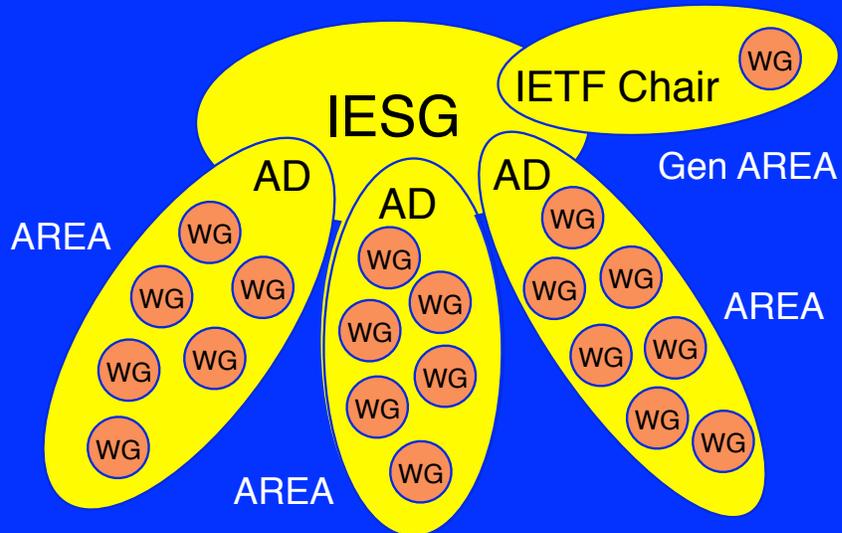
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Top Level View of Organization



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IETF Structure



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IETF Areas

- ◆ Applications Area - 24 WGs
- ◆ General Area - 1 WG
- ◆ Internet Area - 14 WGs
- ◆ Operations and Management Area - 20 WGs
- ◆ Routing Area - 18 WGs
- ◆ Security Area - 20 WGs
- ◆ Transport Area - 24 WGs
- ◆ User Services Area - 4 WGs

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Working With Other Standards Groups

- ◆ IETF structure makes organization-to-organization liaisons hard
 - no one can commit the IETF
 - bottom' s up process
- ◆ best interaction is within working groups
- ◆ but have some formal liaisons
 - ITU-T, ISO/IEC JTC1 SCs, Unicode, WIPO, W3C, ATM Forum, OECD
- ◆ joint WGs with ITU-T & W3C

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Convergence Related WGs

- ◆ Voice Profile for Internet Mail (vpim)
- ◆ IP over Cable Data Network (ipcdn)
- ◆ Internet Traffic Engineering (tewg)
- ◆ IP Routing for Wireless/Mobile Hosts (mobileip)
- ◆ Public-Key Infrastructure (X.509) (pkix)
- ◆ XML Digital Signatures (xmldsig)
- ◆ MultiProtocol Label Swapping (mpls)
- ◆ IP Telephony (iptel)
- ◆ Media Gateway Control (megaco)
- ◆ Multiparty Multimedia Session Control (mmusic)
- ◆ PSTN and Internet Internetworking (pint)
- ◆ Performance Implications of Link Characteristics (pilc)
- ◆ Robust Header Compression (rohc)
- ◆ Service in the PSTN/IN Requesting InTernet Service (spirits)
- ◆ Session Initiation Protocol (sip)
- ◆ Signaling Transport (sigtran)
- ◆ Telephone Number Mapping (enum)

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Convergence Related BOFs

- ◆ IP over optical networks (ipo) BOF
- ◆ Seamless Mobility (seamoby)
- ◆ Common Control and Management (CoMA)
- ◆ Sessions over IP (soip)
- ◆ Provider provisioned VPNs (ppvpn)

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Convergence Technologies

- ◆ many IETF technologies are convergence-related or could be seen as such
- ◆ following is a sample of some of them

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PSTN <-> Internet Control & Status

- ◆ **pint** - tell PSTN what to do
 - place a call
 - send a fax
 - play some speech
- ◆ **spirits** - tell Internet what is going on in PSTN
 - tell web server about PSTN state change
 - e.g. Internet call waiting

Call Scott

Fred is calling

go away

voice mail

answer

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PSTN Signaling

- ◆ **sigtran** - signaling transport
 - Stream Control Transport Protocol - SCTP
- ◆ carry IN signaling over IP
 - some worry about using TCP - flow control delays etc
 - but congestion control is required
 - if it does not work, don't do it**
- ◆ only carries IN signaling
 - makes IP net look like a point to point wire
 - e.g., looks like a private network link to SS7
 - does not get involved in IN addressing
 - does not parse the IN signaling

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Multi Media Control

- ◆ **SIP** - IP telephony signaling
 - end-to-end compatible
 - can use proxies but not required
- ◆ **SDP** - session description
 - describe session
 - media types etc

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Multi Media Transport

- ◆ Real Time Protocol (**RTP**)

 - transport various real time applications

 - recreates timing

 - audio & video codecs (many)

 - HDTV

 - MPEG

 - compressed video

 - telephone signals

 - ...

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IP Phone Control

- ◆ **megaco** (H.248)

- ◆ break up phone switch into media gateway controller (MGC) and media gateways (MGs)

- ◆ protocol between MGC & MGs

 - SIP between MGCs

- ◆ preserve traditional phone architecture

- ◆ dumb(ish) phones, smart server

- ◆ applications in server

- ◆ IP telephony not Internet telephony

 - i.e. using IP as transport but not embracing Internet architecture

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Gateway Location

- ◆ iptel' s **TRIP** enables location servers to exchange reachability information
 - users/systems register with a location server
 - or location servers manually configured
- ◆ SIP proxy and redirect servers & H.323 gatekeepers can query location server for reachability
- ◆ reachability information
 - address family 1 | application | address family 2
 - address family 1: address family being routed
 - application: application for which routes apply
 - address family 2: address type for next hop

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Finding Things Using Phone Numbers

- ◆ Telephone **Number** Mapping (enum) - IETF WG
- ◆ IETF working group - doc in RFC Editor' s queue
 - input: an e.164 style phone number
 - output: one or more URLs
- ◆ uses domain name (DNS) system
 - for phone number of **+ 46 8 9761234**
 - look up **4.3.2.1.6.7.9.8.6.4.e164.arpa**
- ◆ significant political issues
 - who controls per-country mappings?
 - who controls or runs the mappings for a user

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Convergence Technologies, contd.

- ◆ QoS, traffic engineering, provisioning
 - integrated services, differentiated services, traffic engineering, MPLS, CoMa, IP Optical
- ◆ funky links (e.g. wireless)
 - pilc, reliable header compression (rohc)
- ◆ mobility
 - mobile IP, SeaMoby
- ◆ security
 - IPSec, public-key infrastructure (pkix), XML digital signatures

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Predictions

- ◆ some random thoughts and predictions

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Is it IP or Internet Telephony?

- ◆ IP telephony
 - run traditional telephony using IP as wires
- ◆ Internet telephony
 - end-to-end - no carrier involvement in calls for Internet-only calls
- ◆ architectural difference
 - physical or managerial
- ◆ prediction: both will happen
 - 1st IP telephony, then Internet telephony, then IP telephony

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Commoditization of Transport

- ◆ is it bits or applications
 - or class of applications?
- ◆ why should the user pay special for all-IP telephony
 - might ask for special handling (real-time bits)
 - but should charge be based on specific application?
- ◆ carriers need a way to make money
 - fumbling attempts - e.g., AT&T getting piece of action
 - become a billing agent like Do-Co-Mo?

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Can you Afford to Win?

- ◆ infrastructure investment
 - Fortune estimate \$1 T
- ◆ e.g. wireless auctions
 - \$1000/potential customer?
- ◆ how is it going to be paid back?
 - like US canals & railroads?

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Telephony & IP

- ◆ general misunderstanding
 - major revenue assumptions (wrong ones)
- ◆ much of the telephony revenue will evaporate in a move to IP

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The Importance of Phones

- ◆ big issue in IETF development of telephony technology for IP networks
- ◆ phone people assumed that phone traffic would have precedence over all other use
IETF did not agree **I' m more important!**
- ◆ particular issue in responding to congestion
everyone thinks the other guy should back off

I' m more important! I' m more important!
I' m more important!

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QoS

- ◆ different views about the need for QoS
- ◆ many big IP-ISPs do not see a need
- ◆ telco-based ISPs can not imagine live without it
- ◆ 'just throw bandwidth at the problem'
few points of congestion
fixing these would not cost much compared to adding QoS
complex (i.e. expensive) to manage QoS
- ◆ fact: the Internet traffic pattern is not conducive to circuit-based networking

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Multicast

- ◆ current multicast can not be used in the real (ISP) world
 - assume multi-sender but most uses are single-sender
 - very hard to manage, protect infrastructure, bill, addresses
- ◆ new proposal: Source Specific Multicast (**ssm**)
 - take range in existing multicast space and change meaning
 - address is (S,G) - sender IP address & group from sender
 - each sender has 17M addresses
 - single sender, easier to manage, bill, protect etc
 - easy to find sender (IP address is part of group name)

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Who Owns the User?

- ◆ real ISPs (traditional Internet)
 - a service provider owns the customer for that specific service
- ◆ telco-based ISPs
 - the connectivity provider owns the customer for all services
 - e.g. WAP
 - inhibits innovation & restricts competition

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Will Content ever Succeed?

- ◆ has not to date
 - all video-on-demand trial have failed
- ◆ long term carrier assumption of revenue future
- ◆ if you are asking "what is the application"
 - you have already lost
- ◆ many looking for "the killer app"
 - what was killer app for telephone
 - what was killer app for auto?
- ◆ if you must have one: connectivity
- ◆ content will be a service but not the only service

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In Chaos is Innovation

- ◆ remember planning?
 - telco planning cycle ~10 years
- ◆ Internet planning? (what is that?)
- ◆ but telco planning did not yield innovation
 - *69 is the highlight
- ◆ looks like chaos - everyone trying everything
 - but that leads to understanding
 - will also mean many (most) efforts fail
 - "the power of the Internet is chaos"***

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Basic Predictions

- ◆ convergence will happen for many applications
- ◆ redefining “voice service” will take a while
- ◆ convergence will produce commoditization
- ◆ carrier revenue models will be stressed
- ◆ significant regulatory issues
 - universal service fund, wiretapping, e-911, ...
- ◆ privacy - remember it (you will not have it)
- ◆ the Net is too important to the economy to ignore
- ◆ Chinese-style “interesting times”

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“but who is going to make money on that?”

John Mcquillan

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