Current ITEF Efforts and Technology Trends

Is there a future?

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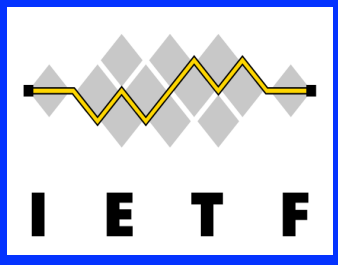
What is the IETF?

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



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!!
- not government approved - great!!
- people not companies

"rough consensus and running code"

An Engineering Organization

- vendors
- users
- network operators
- academics
- researchers
- all as individuals
- no membership
- supported by meeting fees

ISOC supports some functions e.g., RFC Editor

Scale

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

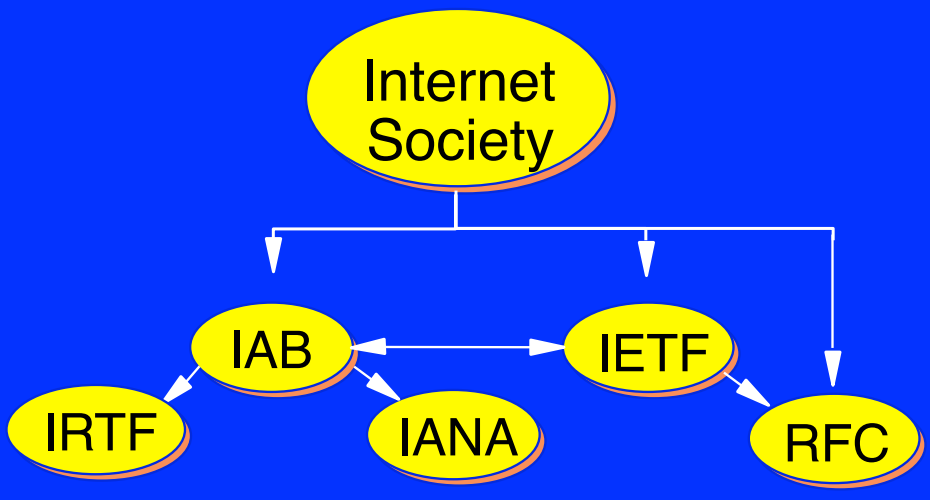
IETF "Standards"

- standards only because people use them
- no formal recognition
- no submitting to "traditional" bodies
  but they keep trying to help

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,

Top Level View of Organization



IETF Structure

- most work done on mailing lists
- 3 times a year face-to-face meetings
- individuals or groups request BOFs
  - exploratory meeting - may lead to working group
- working groups for specific projects
  - about 120 working groups
  - restrictive charters with milestones
  - working groups closed when their work is done
- working groups gathered together into Areas

Area Directors

- most Areas have 2 Area Directors (ADs)
- responsible for setting direction in Area
- responsible for managing process in Area
  - approve BOFs & working groups
    - then go to IESG & IAB for final approval
- reviews working group documents

Working Groups

- this is where the IETF primarily get its work done
  - on mailing lists
  - face-to-face meetings focused on resolving issues (ideally)
- working group focused by charter agreed between chair and area director
  - restrictive charters with milestones
  - working groups closed when their work is done
- charter approved by IESG with IAB advice
- AD with IESG has final say on charter

IETF Areas

- Applications Area
- General Area
- Internet Area
- Operations and Management Area
- Routing Area
- Security Area
- Transport Area
- User Services Area

IETF and Other Standards Bodies

- IETF knows that there are other standards bodies
- but working with them can be hard
- IETF is too bottoms-up & group-driven
- IETF management can not decide to do something on its own
- some joint working groups
  - megaco/ITU-T SG16
  - XML signatures with W3C
  - so far process issues and architectural differences are hard

IETF Transport Area

- currently 24 WGs
  - **telephony**
  - **QoS**
  - **multicast (some of it)**
  - **multimedia**
  - **performance (some of it)**
  - **other**

TSV WGs

Audio/Video Transport (avt)
Differentiated Services (diffserv)
Endpoint Congestion Management (ecm)
IP Performance Metrics (ippm)
IP Telephony (iptel)
Integrated Services (intserv)
Integrated Services over Specific Link Layers (issll)
Media Gateway Control (megaco)
Multicast-Address Allocation (malloc)
Multiparty Multimedia Session Control (mmusic)
Network Address Translators (nat)
Network File System Version 4 (nfsv4)

TSV WGs, contd.

ONC Remote Procedure Call (oncrpc)
PSTN and Internet Internetworking (pint)
Performance Implications of Link Characteristics (pilc)
Reliable Multicast Transport (rmt)
Resource Reservation Setup Protocol (rsvp)
Robust Header Compression (rohc)
Service in the PSTN/IN Requesting InTernet Service (spirits)
Session Initiation Protocol (sip)
Signaling Transport (sigtran)
TCP Implementation (tcpimpl)
Telephone Number Mapping (enum)
Transport Area Working Group (tsvwg)

TSV Pre-WGs & BOFs

IP Storage (ips)

Remote Server Spooling (rspool)

Common Radio Access Protocol Set (CRAPS)

SIP/IN Interworking (SIN)

IP Telephony (iptel)

- PSTN/Internet gateway discovery protocol
  - find the "right" gateway to the PSTN
  - a routing problem
  - **Telephony Routing over IP (TRIP)** protocol
  - due in August 2000
- call processing script language
  - how to tell a switch what you want done with incoming calls
  - **A Language for User Control of Internet Telephony Services (CPL)**
  - due in August 2000

Media Gateway Control (megaco)

- working with ITU SG16
- protocol between a media gateway controllers and media gateways
- decompose a phone switch

  Media Gateway Control Protocol (megaco) a.k.a **H.248**

  done - on RFC Editor Queue

  MIB due now
- some confusion with MGCP

PSTN and Internet Internetworking (pint)

- Internet server (e.g. web server) to PSTN commands

  click 2 call - place call between number A and number B

  click 2 fax - send this data to phone number A as a FAX

  access to voice - call number A and play this voice data

  The PINT Service Protocol: Extensions to SIP and SDP for IP Access to Telephone Call Services

  done - RFC 2848

  MIB under review by IESG

Robust Header Compression (rohc)

- develop compression schemes for low bandwidth - high error rate links (e.g. cellular radio)
- due fall 2000

Service in the PSTN/IN Requesting Internet Service (spirits)

- protocol to let Internet-based servers react to information from the PSTN
  - e.g. Internet Call Waiting (ICW)
  - due fall 2000

Session Initiation Protocol (sip)

- broken out from mmusic
- extensions to SIP protocol
- advance SIP on standards track
- SIP seen as competitor to H.323

Session Invitation Protocol (sip)

done RFC 2543

MIB and extensions due during 2000

Signaling Transport (sigtran)

- protocol to carry IN signaling protocols over IP networks

  e.g. SS7, Q.931 ...

  Stream Control Transport Protocol (SCTP)

  under review by IESG

  MIB due this summer
- protocol revised to be more general

Telephone Number Mapping (enum)

- for Internet-based hosts
- map from phone number to URL
  - can get different URLs based on application
  - voice vs. FAX
- could be URL pointing to actual host or gateway
  - **E.164 numbers and DNS (enum)**
  - in working group last-call

Remote Server Spooling (rspool)

- soon to be working group
  - was Data Distribution Protocol (ddp)
- fault tolerant data transfer mechanism over IP networks
- includes name-based addressing model
  - isolates a logical communication endpoint from its IP address(es)
  - transparent support for server-pooling and load sharing

Common Radio Access Protocol Set (craps)

- BOF
- protocol facilitating seamless handover
- support seamlessly roaming between different wireless technologies

SIP/IN Interworking (sin)

- BOF
- control IN services from SIP environment
  - IN Call Model must be interpreted for the SIP-based IP telephony environment
  - IN messages must be mapped into (sequences of) SIP messages and vice versa
  - IN parameters must be mapped into existing SIP parameters (or relevant SIP extensions must be defined) and vice versa

SIP/H.323

- non-working group effort
- map functions between H.323 and SIP-based systems
- not a 1:1 map
- may produce an informational RFC

IP as a Common Bearer Service

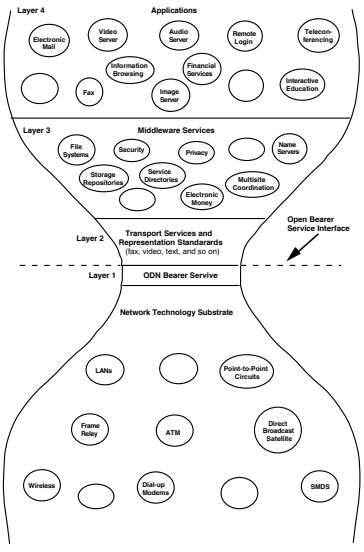


FIGURE 2.1 A four-layer model for the Open Data Network

From: Realizing the Information Future

Convergence

- big buzzword
- why run N networks when all can be seen as data
- assumption is that combined networks will be cheaper

Convergence Myths

- phone traffic is special
  - only in that you pay for it by the minute
- need to change IP to support phones
  - never needed to change IP for an application before
  - voice will be a "niche market" (but not for $$)
- need to use phone #s as IP addresses
  - physics says this is *very* hard
- video on demand will be a big money maker
  - couch potato heaven
  - has not been true to date

Context: Convergence as Mantra

- is IP the ATM of today?
  - ATM was the answer, what was your question?
  - note that ATM is no longer ***the*** answer
- is convergence a mantra or a direction?
- do people building networks want it?
- is MPLS IETF's ATM?
- how useful is circuit switching in an IP world?
  - not very for applications
  - VPNs & long lived flows (video on demand) OK

Convergence as Reality

- mixed world
  - hard to justify tearing out existing circuit-switched nets
    - known operations, significant amortization xx
  - no reason to recreate it if starting new
- very mixed view on economics of convergence
  - yes equipment is cheaper but equipment is not a big part
- phone companies are very worried
  - why would I call you through them? (just so they can charge?)
- too much focus on QoS

Convergence and 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

Architecture Example

- within IETF - megaco vs. SIP
- megaco/H.248:
  - explode phone switch
  - into server & gateways (MGC & MGs)
  - but still "looks" and manages like a a phone switch
  - applications in server
- SIP / H.323 (original concept)
  - end-to-end to smart phones
  - can work on their own or with local light-weight servers
  - applications in phone not network

Phone Net vs. Internet

- phone net
  - applications & services in network
  - applications built & installed by phone switch company
  - services provided by phone company
  - hard to do 3rd-party applications & services
- Internet
  - applications & services in computers at edges
  - applications & services can be built by users
  - applications & services can be installed by users
  - no permission required from network operator

Quote

- from Sun, 16 Apr 2000 11:10:57 +0200

```
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
 decieded this.
```

IP Telephony, contd.

- QoS seen as a real issue
  - latency in particular
    - should be < 300 msec RTT
  - but packet loss seen as a problem
    - but codecs hide some loss
- is "toll quality" a requirement?
  - is it the only option?
  - remember the cell phone!

IP Telephony Technology

- disagreement over base IP telephony protocol
  - H.323 vs. SIP
- H.323
  - originally LAN conferencing standard
    - expanded to Internet
  - ITU standard, strongly supported by traditional telco industry
- SIP
  - multi-media conferencing standard - designed for 'Net
  - IETF standard, gaining support (e.g., VON conference)

WAP Example

- Wireless Application Protocol (WAP)
- light-weight protocol to terminal
  to deal with low-bandwidth & lossy link
- reduced function HTTP, TLS etc
- must be translated by gateway to talk to real 'Net
- who owns the gateway, can the user chose?
- customer lock-in

Dial Around

- SIP & H.323 permit direct connections
  signaling can go between end nodes
  can also use proxy/gatekeeper
    but not required
- if connection to phone is IP
  what is to prevent me from calling you
    and not telling the operator?
  maybe you better have something I want
    e.g. advanced services

Commoditization of Transport

- its 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?

Musings on Technology

End-to-End Model

- *state should be maintained only in the endpoints, in such a way that the state can only be destroyed when the endpoint itself breaks*
- i.e. no session-specific state in the network
  - else inhibit reliability (e. g. rerouting)
- only the endpoint knows what it needs from the network
- middleboxes etc make things complex
  - NATs, caches etc
- change inhibits innovation

Link Splitters

- ATM & SONET subdivide links
  - important where you need to do that
- questionable in network core
  - need a links' worth of bandwidth between points
- may make sense on access links
  - integrated access devices

Telephony & IP

- general misunderstanding
  - major revenue assumptions
- much of the telephony revenue may evaporate in a move to IP
- significant regulatory issues
  - universal service fund
  - wiretapping
  - e-911
  - priority for emergency communications

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*"

ATM as a Symbol

- ATM was seen as ***the way***
- part of that was the controllability
  give the user what he needs (at least what **we** say he needs)
- Internet geeks said ATM was just another link layer
  not the last networking technology
- future Internet health depends on uncontrollability
  at least in the space of what I can create

What will the role of IPv6 be?

- IPv6 is the life raft that we will need to transfer to
- imagine an on-line China
- there is no way for v4 to last forever at the current rate of silicon cockroach growth
- the question is not if - its when
- my best guess - after uncle Bill ships
  in Windows/NT 200x
- note - no real change to applications - v4 can do it all other than address size
  NATs (and firewalls) change the timescale

Quality of Service

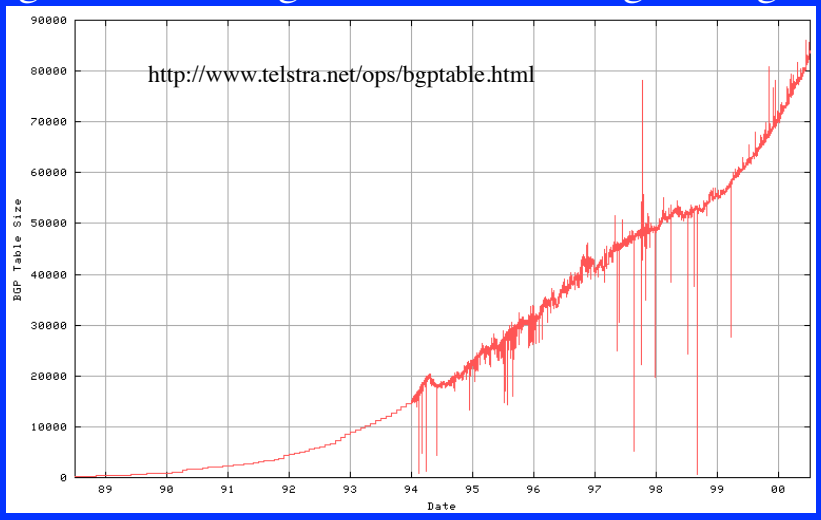
- is the Internet a one trick pony?
  - only 'best-effort' service
  - currently QoS to ISP means ' I will accept your packets"
- the Internet needs multiple "products"
  - better reliability for better money
- IETF working on QoS technology
  - coming to your network soon
  - RSVP & diffserv
- but real problems are business

QoS, contd.

- 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
- remember: this is the Internet!

Internet Routing

- significant scaling issues with existing routing



Internet Routing, contd.

- no new proposals on the table right now
- current trend means most current routers will die in a few years
- too much complacency in research community

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)

Network Monitoring & Management

- we are not doing network management
  - only doing element monitoring
- policy-based management may help on control side
  - but does not help on monitoring side
- current products are too geeky

AAA

- authentication, authorization and accounting
- major problem for any QoS-effected service
  - are the packets from Fred?
  - does he have the needed authority?
  - who to send the bill to
- RADIUS is a start
- IETF AAA WG is working on the issue

Applications

- what will the future big applications be?
  - who predicted the web?
- hard to guess
- demands of network more important than specific application
  - QoS type, security, middlebox support, etc

Internationalization

- what about the rest of the world?
  - most people can not have a web site using their name
- potential for fragmenting the Internet
- Asian efforts underway
  - see IETF as too slow
  - may produce technology that will break applications
    - some think that is a good idea

Security

- tension with regulations (e.g. wiretapping)
- know how to make very good security
  - but good security blocks law enforcement
- supports privacy
  - many providers on the Internet do not like privacy
- DoS attacks are hard to protect against
  - ISP-based filters help

Musings on Business

ISPs

- what is an ISP?
  - traditional ISPs have IP history
  - telco-based have circuit history
- what will it be?
  - telcos have the $ but generally not the clue
    - try to remake the Internet into telco model
    - but assume that content will rule

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

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

Social Pressures

- the Internet is aggressively non-national
  - the 1st amendment is a local ordinance
- threat to "order"
  - as information sometimes is
- governments feel they must "protect" citizens
  - e.g. China
- Internet routes around censorship
- what authority does the FCC have?

Regulations

- regulators are in trouble
- current regulations are based on service
  - if you offer telephone service you get telephone regulations
  - if you offer video service then you get cable TV regulations
- what do they do with a converged network?
- regulations push social and revenue goals
  - universal service fee, content controls
- they will figure out a way
  - they have motivations (tax revenue, content control)

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

John Mcquillan