The IETF: Standards and non-Standards

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Outline

- IETF overview
- IETF IP QoS work
- smart wires

What is the IETF?

- an engineering organization
- a group of people who solve Internet problems

An Engineering Organization

- vendors
- users
- network operators
- academics
- researchers
- all as individuals
- no membership

A Short History of the IETF

- initial DARPA research in 1970's using NCP
  - Telnet
  - file transfer
  - electronic mail
- production network
  - definition of Internet Activities Board (IAB)
  - IP4 and TCP deployed 1981-1983
  - MILNET/ARPANET division 1983

IAB Oversight Period

- 1986
  - Internet Assigned Number Authority (IANA)
  - Internet Research Task Force (IRTF)
  - Internet Engineering Task Force (IETF)
  - some other task forces
- 1987
  - Working groups
- 1988
  - Internet Engineering Steering Group (IESG)

IAB Oversight Period, contd.

- 1989
  - dissolution of other task forces
- 1992
  - leadership redefined
  - IAB => "Internet Architecture Board"
  - IESG: manages the IETF & approve standards

1992: Internet Society Oversight

- process evolution (poised/poisson)
  - Standards track detailed - RFC 2026
  - Intellectual property rights (IPRs)
  - Handling of appeals
- Internet Society: interface to outside world
  - Corporate / legal umbrella
  - Evangelism - INET conference
  - Policy areas

The Role of IETF in the Development of the Internet

- protocol definition
- infrastructure issues

Protocol Definition

- all infrastructure protocols since 1986
- Examples:
  - PPP
  - OSPF
  - SNMP
  - HTTP 1.1
  - ...

Infrastructure Issues

- routing and addressing
  - IP6 addressing
  - network address translation
  - BGP policy routing
- security
  - IPSEC authentication
  - IPSEC encryption
  - ISAKMP key exchange

Infrastructure Issues, contd.

- next generation issues
  - IP/ATM
  - Label switching
- quality of service issues
  - intserv
  - RSVP
  - diffserv

The Relationship Between the IETF and Other Standards Bodies

- ITU-T
- ATM forum
- IEEE
- W3C
- DAVIC
- ...

Types of Standards

- de jure standards
- de facto standards
  - corporate consortia
  - individual efforts

De Jure Bodies

- ITU-T
- ISO
- IEEE
- ANSI

Closed Industry Consortia

- W3C
- DAVIC
- ATM Forum
- Frame Relay Forum

McLuhan's global village

IETF

IETF "Standards"

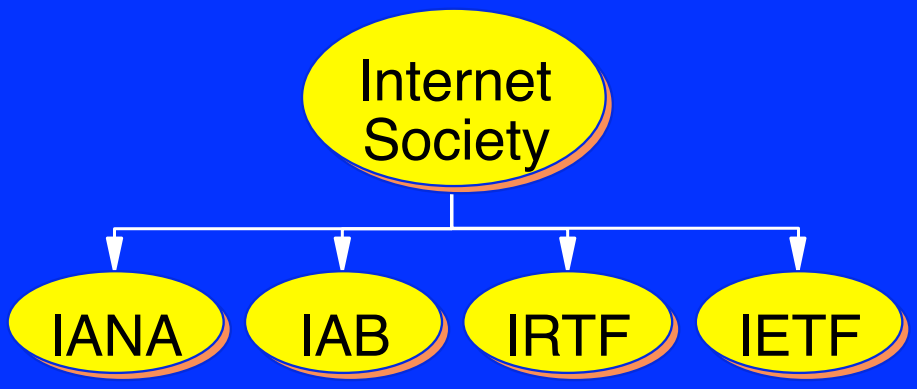
- standards only because people use them
- no formal recognition
- no submitting to "traditional" bodies

Relationships:

- liaisons / representatives
  - ITU-T, ISO study groups, ATM Forum ...
- share people with other organizations
  - more effective than formal liaisons
  - but confuse other standards organizations
- growing area but culture clash
  - IETF is mostly bottoms up
- new-work mailing list
  - to pre announce new working groups and BOFs
  - for representatives of other standards groups

The IETF Standards Process

Top Level View of Organization



Internet Research Task Force (IRTF)

- focused on long term problems in Internet
  - reliable multicast
  - multicast routing
  - congestion management
  - end to end protocols
  - etc.

Internet Assigned Number Authority (IANA)

- assigns numbers and keeps them from colliding
  - Protocol numbers
  - IP addresses
    - mostly delegated to IP Address registries
  - Names
    - mostly delegated to DNS name registries
- working out relationship between ICANN & IETF over IANA protocol related functions

Protocol numbers

- IP protocol numbers
- well known TCP/UDP ports
- PPP protocol ids
- MIME types
- etc.

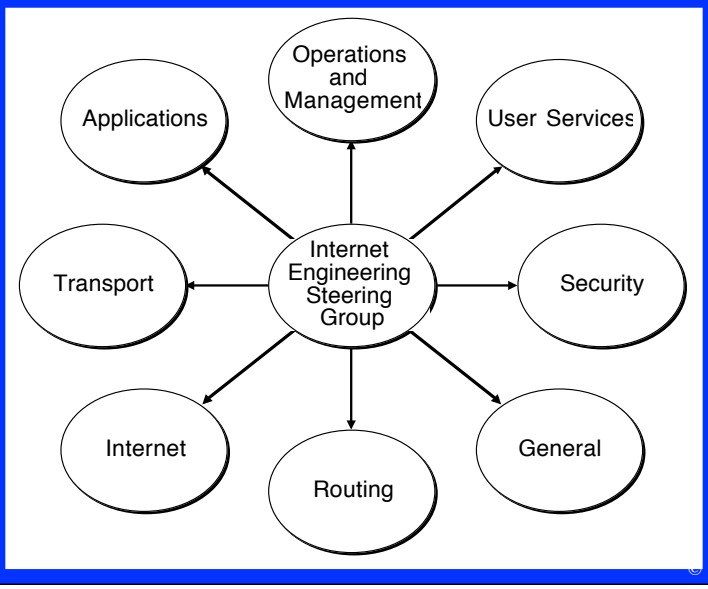
RFC Editor

- was Jon Postel et al
  now et al
- rfc-ed@isi.edu
- supported by the Internet Society

IETF Chair

- chair of IESG
- selected by nomcom
- director of General Area
- ex officio member of IAB
- Chief Talking (and traveling) Officer

IETF Areas



Area Directors

- selected by nomcom
- 2 year terms
- most Areas have 2 ADs
- responsible for setting direction in Area
- responsible for managing process in Area
  approve BOFs & working groups

BOFs

- usually precede formation of a Working Group
- group of people interested in a topic
- convince an AD that they have a good idea - one worth exploring
- need description and agenda before a BOF can be scheduled
- BOFs generally only meet once
- can lead to a WG or can be a one time thing

Working Groups

- this is where the IETF primarily get its work done
- focused by charter agreed between chair and area director
  - specific deliverables
  - documents and timetable
- approved by IESG with IAB guidance
- 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

General Area

- Area director(s)
  Fred Baker <fred@cisco.com>
- Working groups:
  Authentication, Authorization and Accounting (aaa)
  Policy Framework (policy)
  Process for Organization of Internet Standards ONgoing (poisson)

Applications Area

- Area director(s)
  - Keith Moore <moore@cs.utk.edu>
  - Patrik Faltstrom <paf@swip.net>
- Working groups:
  - Application Configuration Access Protocol (acap)
  - Application MIB (applmib)
  - Calendaring and Scheduling (calsch)
  - Common Indexing Protocol (find)
  - Content Negotiation (conneg)
  - DAV Searching and Locating (dasl)
  - Detailed Revision/Update of Message Standards (drums)
  - Electronic Data Interchange-Internet Integration (ediint)
  - Extensions to FTP (ftpext)
  - HyperText Transfer Protocol (http)
  - Instant Messaging and Presence Protocol (impp)
  - Internet Fax (fax)
  - Internet Open Trading Protocol (trade)
  - Internet Printing Protocol (ipp)
  - LDAP Duplication/Replication/Update Protocols (ldup)
  - LDAP Extension (ldapext)
  - Large Scale Multicast Applications (lsma)
  - MIME Encapsulation of Aggregate HTML Documents (mhtml)
  - Mail and Directory Management (madman)
  - Message Tracking Protocol (msgtrk)
  - NNTP Extensions (nntpext)
  - Printer MIB (printmib)
  - Schema Registration (schema)
  - Telnet TN3270 Enhancements (tn3270e)
  - Uniform Resource Locator Registration Procedures (urlreg)
  - Uniform Resource Names (urn)
  - Usenet Article Standard Update (usefor)
  - WWW Distributed Authoring and Versioning (webdav)
  - Web Replication and Caching (wrec)

Internet Area

- Area director(s)
  - Jeffrey Burgan <burgan@corp.home.net>
  - Thomas Narten <narten@raleigh.ibm.com>
- Working groups:
  - AToM MIB (atommib)
  - DNS IXFR, Notification, and Dynamic Update (dnsind)
  - Dynamic Host Configuration (dhc)
  - Frame Relay Service MIB (frnetmib)
  - IP Over Fibre Channel (ipfc)
  - IP Over IEEE 1394 (ip1394)
  - IP over Cable Data Network (ipcdn)
  - IP over VBI (ipvbi)
  - IPNG (ipngwg)
  - Interfaces MIB (ifmib)
  - Internetworking Over NBMA (ion)
  - PacketWay (pktway)
  - Point-to-Point Protocol Extensions (pppext)
  - Service Location Protocol (svrloc)

Operations and Management Area

- Area director(s)
  - Randy Bush < randy@psg.com>
  - Bert Wijnen <wijnen@vnet.ibm.com>
- Working groups:
  - ADSL MIB (adslmib)
  - Benchmarking Methodology (bmwg)
  - Bridge MIB (bridge)
  - Distributed Management (disman)
  - Entity MIB (entmib)
  - Ethernet Interfaces and Hub MIB (hubmib)
  - G and R for Security Incident Processing (grip)
  - MBONE Deployment (mboned)
  - Network Access Server Requirements (nasreq)
  - Next Generation Transition (ngtrans)
  - Physical Topology MIB (ptopomib)
  - Remote Authentication Dial-In User Service (radius)
  - Remote Network Monitoring (rmonmib)
  - Roaming Operations (roamops)
  - Routing Policy System (rps)
  - SNMP Agent Extensibility (agentx)
  - SNMP Version 3 (snmpv3)
  - The Internet and the Millennium Problem (2000)
  - Uninterruptible Power Supply (upsmib)

Routing Area

- Area director(s)
  - Rob Coltun <rcoltun@lightera.com>
  - TBA
- Working groups:
  - Data Link Switching MIB (dlswmib)
  - General Switch Management Protocol (gsmp)
  - IP Routing for Wireless/Mobile Hosts (mobileip)
  - IS-IS for IP Internets (isis)
  - Inter-Domain Multicast Routing (idmr)
  - Inter-Domain Routing (idr)
  - Mobile Ad-hoc Networks (manet)
  - Multicast Extensions to OSPF (mospf)
  - Multicast Source Discovery Protocol (msdp)
  - Multiprotocol Label Switching (mpls)
  - Open Shortest Path First IGP (ospf)
  - Protocol Independent Multicast (pim)
  - QoS Routing (qosr)
  - Routing Information Protocol (rip)
  - SNA DLC Services MIB (snadlc)
  - SNA NAU Services MIB (snanau)
  - UniDirectional Link Routing (udlr)

Security Area

- Area director(s)
  - Jeffrey Schiller <jis@mit.edu>
  - Marcus Leech <mleech@nortel.ca>
- Working groups:
  - An Open Specification for Pretty Good Privacy (openpgp)
  - Authenticated Firewall Traversal (aft)
  - Common Authentication Technology (cat)
  - Domain Name System Security (dnssec)
  - IP Security Protocol (ipsec)
  - Intrusion Detection Exchange Format (idwg)
  - One Time Password Authentication (otp)
  - Public-Key Infrastructure (X.509) (pkix)
  - One Time Password Authentication (otp)
  - Public-Key Infrastructure (X.509) (pkix)
  - S/MIME Mail Security (smime)
  - Secure Shell (secsh)
  - Simple Public Key Infrastructure (spki)
  - Transport Layer Security (tls)
  - Web Transaction Security (wts)

Transport Area

- Area director(s)
  - Scott Bradner <sob@harvard.edu>
  - Vern Paxson <vern@ee.lbl.gov>
- Working groups:
  - Audio/Video Transport (avt)
  - Differentiated Services (diffserv)
  - 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)
  - ONC Remote Procedure Call (oncrpc)
  - PSTN and Internet Internetworking (pint)
  - RSVP Admission Policy (rap)
  - Realtime Traffic Flow Measurement (rtfm)
  - Resource Reservation Setup Protocol (rsvp)
  - Signaling Transport (sigtran)
  - TCP Implementation (tcpimpl)
  - TCP Over Satellite (tcpsat)

User Services Area

- Area director(s)
  - April Marine <amarine@globe.arc.nasa.gov>
- Working groups:
  - Responsible Use of the Network (run)
  - User Services (uswg)

IETF Secretariat

- located physically
  - Corporation for National Research Initiatives (CNRI)
    - Reston Virginia (Washington DC)
- runs
  - plenary meetings
  - mailing lists
  - Internet draft directory
- coordinates
  - day to day work of IESG and working groups

What is a "Request For Comments" (RFC)?

- not all RFCs are standards!
  - though some vendors imply otherwise
- many types of RFCs

RFC Repository Contains:

- Standards
  - OSPF
- Obsolete Standards
  - RIPv1
- requirements
  - Host Requirements
- policies
  - Classless InterDomain Routing
- April fool's day jokes
  - IP on Avian Carriers
- poetry
  - 'Twas the night before startup
- white papers
  - On packet switches with infinite storage
- corporate documentation
  - Ascend multilink protocol (mp+)
- experimental history
  - Netblt

Working Papers

- Internet-Draft
  - random or non-random thoughts
  - input to the process
  - zapped after 6 months
  - all RFCs must pre-exist as IDs

IETF Approval Process

- rough consensus
  - unanimous agreement not required
- Working Group "last-call"
  - two week comment period in working group
- IETF "last-call"
  - two week IETF-wide comment period
- IESG review

Standards Track Levels:

- Best Current Practices (BCP)
  generally policies or procedures
- Proposed Standard (PS)
  good idea, no known problems
- Draft Standard (DS)
  multiple interoperable implementations
- Standard (STD)
  wide use

- fly before buy

Archives

- Informational (FYI)
- Experimental
- Historical

Transport Area QoS Working Groups

- Integrated Services (intserv)
  guaranteed and controlled load services
- Integrated Services over Specific Link Layers (issll)
  Intserv for various link types, including ATM
- Resource Reservation Setup Protocol (rsvp)
  signaling protocol for Integrated Services networks
  may become general IETF signaling protocol

TSV Area QoS Working Groups, contd.

- RSVP Admission Policy (rap)
  router <-> policy server protocol for RSVP
- Differentiated Services (diffserv)
  non-flow based QoS protocols
- IP Performance Metrics (ippm)
  measure performance of networks

IEEE Related IETF Work

- "IP over foo" - started in 1985
  - RFC 948 - Two methods for the transmission of IP datagrams over IEEE 802.3 networks (OBS)
  - RFC 1042 - Standard for the transmission of IP datagrams over IEEE 802 networks (STD)
  - RFC 1390 - Transmission of IP and ARP over FDDI Networks
  - RFC 2464 - Transmission of IPv6 Packets over Ethernet Networks
  - RFC 2470 - Transmission of IPv6 Packets over Token Ring Networks
  - RFC 2467 - Transmission of IPv6 Packets over FDDI Networks

IEEE Related IETF Work, contd.

- MIBs
  - RFC 1230 - IEEE 802.4 Token Bus MIB
  - RFC 1231 - IEEE 802.5 Token Ring MIB
  - RFC 1368 - Definition of Managed Objects for IEEE 802.3 Repeater Devices
  - RFC 1512 - FDDI Management Information Base
  - RFC 1515 - Definitions of Managed Objects for IEEE 802.3 Medium Attachment Units (MAUs)
  - RFC 1516 - Definitions of Managed Objects for IEEE 802.3 Repeater Devices
  - RFC 1743 - IEEE 802.5 MIB using SMIv2

IEEE Related IETF Work, contd.

- more MIBs
  - RFC 1749 - IEEE 802.5 Station Source Routing MIB using SMIv2
  - RFC 2108 - Definitions of Managed Objects for IEEE 802.3 Repeater Devices using SMIv2
  - RFC 2239 - Definitions of Managed Objects for IEEE 802.3 Medium Attachment Units (MAUs) using SMIv2
  - RFC 2266 - Definitions of Managed Objects for IEEE 802.12 Repeater Devices

IETF QoS IEEE-Related Work

- issll working group is prime focus of QoS work
- three Internet-Drafts
  - A Framework for Providing Integrated Services Over Shared and Switched IEEE 802 LAN Technologies
  - SBM (Subnet Bandwidth Manager): A Protocol for RSVP-based Admission Control over IEEE 802-style networks
  - Integrated Service Mappings on IEEE 802 Networks

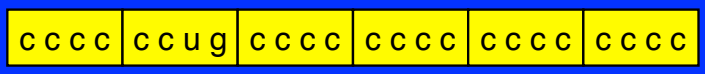
Use of IEEE MAC Addresses in IPv6

- RFC 2374 - An IPv6 Aggregatable Global Unicast Address Format

FP	format prefix
TLA	top-level aggregation identifier
res	reserved for future use
NLA	next-level aggregation identifier
SLA	site-level aggregation identifier
interface ID	interface identifier

IPv6 Interface ID

- 64 bits
- 8-byte (or expanded 6-byte) MAC address of interface
- can also use DHCPv6
- 1st 3 bytes of interface ID



c = bit of company id
u = universal / local bit (complemented)
g = individual / group bit

Cooperation with Other Standards Groups

- ideal - multiple groups work on one protocol
  - published by one group to prevent out of sync versions
  - e.g. Internet FAX, RTP
- real - does not always happen
  - too many groups working in telephony area
  - other groups finding IETF's area important
  - differences in architectural view
    - IETF has a "stupid network" bias

Smart Wires

- in an end to end world, smart link-layers are a concern
- "qos" has different meanings in link-layers
  - prioritization - e.g. 802.1Q
  - flow control - e.g. ATM ABR
- prioritization can be very helpful if packet mapping can cooperate with end-to-end signaling
  - e.g. RSVP & intserv
  - issll is802 work an example

Smart Wires Which Know Better

- link-level flow control can be an issue
- creates layered control systems with different characteristics at the different layers
  - what is effect on end-to-end flow management of random (to the ends) changes in apparent link latency?
- one answer offered is 1 RTT worth of buffering per session at entry points
  - may deal with loss but far from clear effect on flow rate

End-to-End is TCP

- much of current data traffic is TCP/IP
  - growing, but still small, amount of UDP (e.g. RTP)
  - some other protocols being worked on
- TCP flow control developed over many years
- multiple phases
  - slow start
  - congestion avoidance
  - loss response
- effect of a link-layer flow-control has to be understood for each phase

Prediction

- classical control system theory recommends against layered control systems
- effect on TCP not well known
  - same for other end-to-end rate control protocols
- seems to be more of a research rather than a standards item today
- prediction - data systems will make little use of link-level flow control systems when end-to-end is longer than a link
  - unless interconnection devices are part of end to end signaling mechanism

Questions?