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
  difserv
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 Society

IANA  IAB  IRTF  IETF

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

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

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 (edfmt)
  - 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 (mhhtml)
  - 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 (dnsim)
  - Dynamic Host Configuration (dhc)
  - Frame Relay Service MIB (frnetmib)
  - IP Over Fibre Channel (ippfc)
  - IP Over IEEE 1394 (ip1394)
  - IP over Cable Data Network (ipcndn)
  - 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)
  - Multprotocol 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 (sshs)
  - 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 (mallocc)
  - Multiparty Multimedia Session Control (mmsstartup)
  - 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 (rsyp)
  - Signaling Transport (sigtran)
  - TCP Implementation (tcpimpl)
  - TCP Over Satellite (tcpv4sat)
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

```
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<th></th>
<th>FP</th>
<th>TLA</th>
<th>res</th>
<th>NLA</th>
<th>SLA</th>
<th>interface ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td></td>
<td></td>
<td>8</td>
<td>24</td>
<td>16</td>
<td>64</td>
</tr>
</tbody>
</table>
```

- 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 c c c c c u g c c c c c c c c c c c c
```

- 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?