
The IETF and the Future of the Internet

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Internet Future - 1

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Topics

- ◆ the IETF
- ◆ what got us here
- ◆ addressing
- ◆ routing issues
- ◆ wireless
- ◆ network convergence

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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”

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IETF Structure

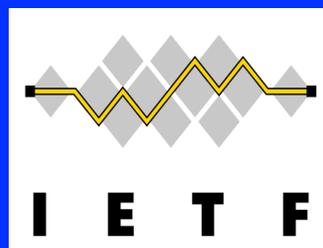
- ◆ most work done on mailing lists
- ◆ 3 times a year face-2-face meetings
- ◆ individuals or groups request BOFs
 - exploratory meeting - may lead to working group
- ◆ working groups for specific projects
 - about 120 working groups
 - restrictive charters with milestones
 - working groups closed when their work is done
- ◆ working groups gathered together into Areas
 - each area has 1 or 2 Area Directors - managers

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IETF Areas

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



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IETF Management

- ◆ Area Directors as a group plus IETF chair form Internet Engineering Steering Group (IESG)
standards approval body of the IETF
- ◆ Internet Architecture Board (IAB)
advice body
- ◆ Internet Society
legal umbrella over IETF
provides financial support

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Selecting IETF Management

- ◆ IESG & IAB members have two year terms
- ◆ picked by a nominations committee (nomcom)
- ◆ nomcom selected randomly from list of volunteers
 - volunteers have to have been at 2 of last 3 IETF meetings
- ◆ IESG nominees approved by IAB
- ◆ IAB nominees approved by ISOC Board

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IETF Standards Process

- ◆ proposed technology published as Internet Draft (ID)
 - temporary documents
- ◆ discussed in a working group - creates revised IDs
- ◆ after working group consensus ID sent to IESG
- ◆ IESG issues IETF “Last-Call” (2 weeks)
 - anyone in IETF can comment
 - IESG considers comments and its own review
 - may approve publication as standards track RFC
 - may point out issues to working group

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RFCs (not “requests for comment”)

- ◆ RFC does not mean standard
- ◆ different types of RFCs
 - standards track
 - Proposed Standard - good idea, no known flaws
 - Draft Standard - multiple interoperable implementations
 - Internet Standard - widespread adoption
 - Best Current Practice - best way to perform function
 - non-standards track
 - Informational - for the reader’s information
 - Experimental - encourage experimentation
 - Historic - do not do this, for information only

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IETF Appeals Process

- ◆ IETF decisions can be appealed
- ◆ 1st to WG chair
- ◆ then to Area Director
- ◆ then to IESG
- ◆ then to IAB
- ◆ if claim is that the process (and not the implementation of the process) is broken then appeal can be made to the ISOC Board

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IETF & Other Standards Bodies

- ◆ work together when welcomed
- ◆ but structure different enough that communication can be hard
 - bottom up not top down
 - few formal liaisons - speak for yourself
 - competing architectural models
 - sometimes redundant work

Standards Organizations, contd.

- ◆ existing organizations are not going away
 - new forums being formed every day
- ◆ organizations should work together where they can
 - sometimes hard due to process issues
 - e.g.: how & what time frame for approval process
 - document access
 - sometimes hard due to organizational bias
 - “we know better”

The Internet

- ◆ started to support research or to survive nuclear war (or both)
- ◆ was ignored by traditional networking people and sometimes opposed
 - e.g. telephone companies
- ◆ since WWW fastest growing technology in history
- ◆ *THE* future, not just a part of the future
 - if you believe the pundits
 - but the same pundits said that ATM was going to take over

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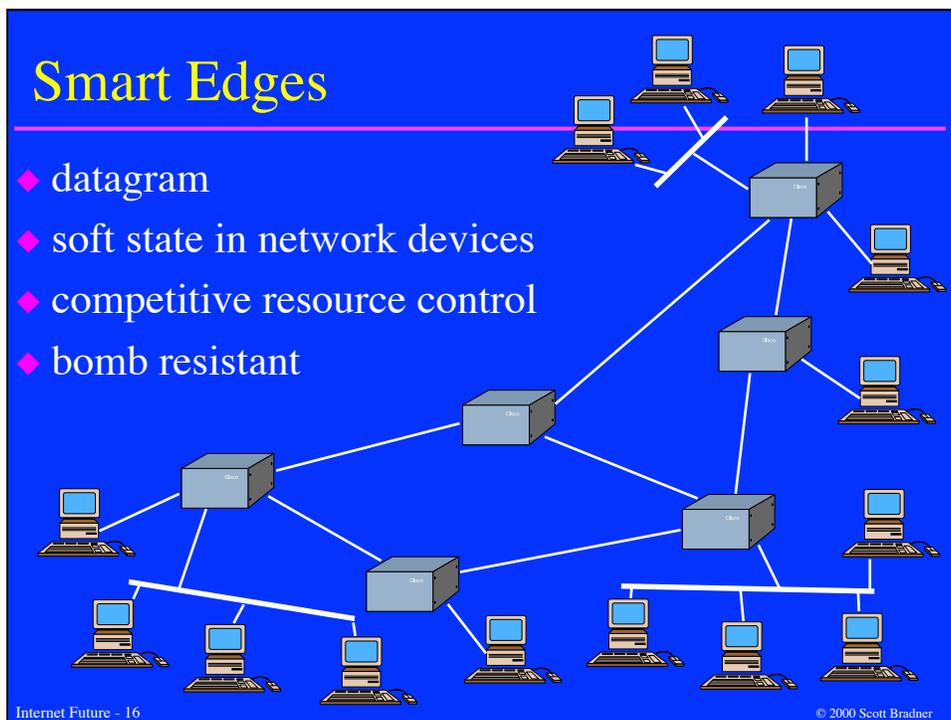
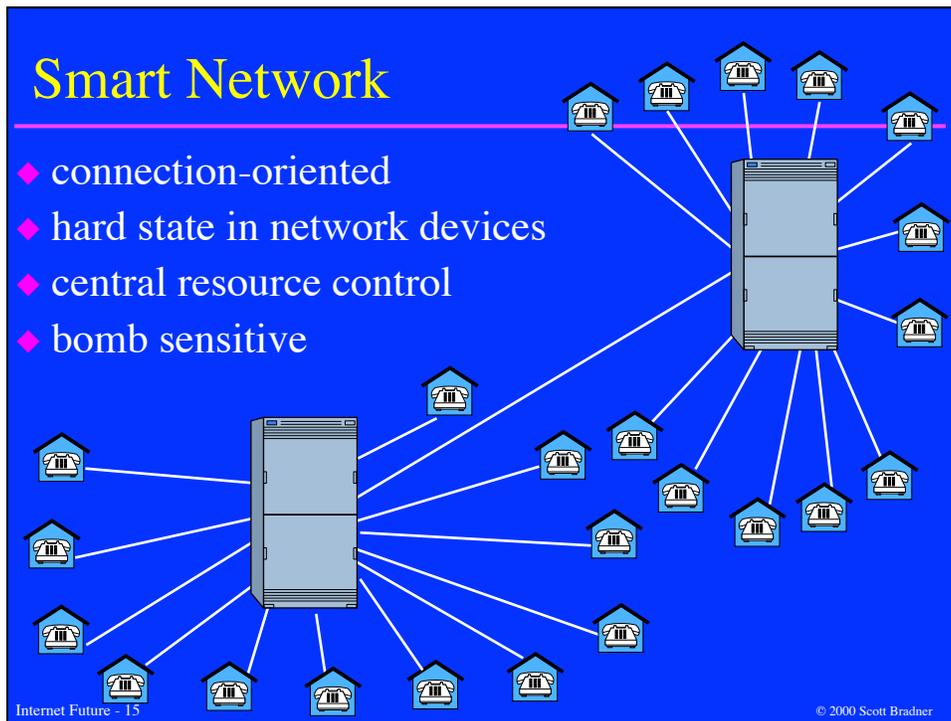
In the Beginning

- ◆ in the beginning (and now)
- ◆ there was (is) philosophy
- ◆ smart network vs. smart edges
- ◆ centralized vs. distributed
- ◆ circuits vs. datagrams
- ◆ redundancy vs. reliability for reliability

- ◆ Internet: smart edges, distributed, datagrams
- ◆ phone co: smart net, centralized, circuits

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Implications of Circuit vs Packet

- ◆ paths through network are not stable
 - change based on
 - link failure
 - traffic engineering
 - routing instability
 - link utilization (someday)
- ◆ impacts QoS
 - hard to reserve resources
 - unpredictable QoS
 - IBM: *“can not build corporate network out of TCP/IP”*

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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

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Internet Architecture

- ◆ randomly interconnected ISPs
- ◆ no defined “backbone”
- ◆ no regulatory backbone
- ◆ supports all sorts of applications
 - service providers do not control what applications are run

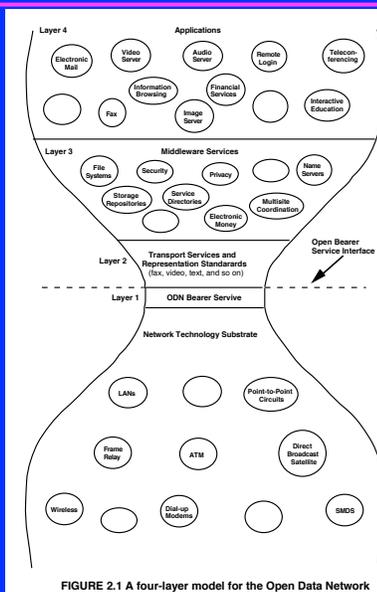
Internet architecture is not changed to support specific applications

- ◆ not understood by some with ‘important’ applications

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IP as a Common Bearer Service



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

From: Realizing the Information Future

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Internet Features

- ◆ you do it
- ◆ you don't need permission
- ◆ you don't have to wait for them
- ◆ 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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Hierarchical Routing and Addressing

- ◆ Internet network topology is a rough hierarchy
 - quite rough in places
- ◆ if addressing hierarchy not related to topology
 - hierarchy does not help routing table size
- ◆ topology hierarchy must be reflected in addressing
- ◆ therefore addressing must follow network topology
 - but diminishing returns at higher-levels of network
- ◆ this will not change with IPv6
- ◆ not just a question of bigger processors in routers

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IP Addresses and Phone Numbers

- ◆ too common assumption: need to use phone #s as IP addresses
- ◆ more and more phone #s are not addresses
 - they are names that get mapped into addresses
 - should be treated as names (e.g. DNS names)
- ◆ physics says routing phone #s is **very** hard
 - phone #s are not a good enough hierarchy

Internet Routing

- ◆ routing done per datagram
 - not per session
 - routers in network do not understand sessions
- ◆ routing table size impacts
 - memory requirements in routers
 - processing time - non-linear increase
 - dynamism - more entries mean more change
 - routing data exchange process - more information to move to more places more often

Routing Issues

- ◆ too much mistrust
 - BGP-4 is mostly configurations to permit mistrust
- ◆ too fragile
 - too easy to misconfigure, too easy to disrupt
- ◆ poor scaling characteristics
 - requires CIDR adherence
- ◆ may also need application-level routing
 - to find servers, gateways, hosts using alternate addressing scheme - e.g. phone numbers, URLs, users ...

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Wireless

- ◆ wireless is not just one technology
 - different bandwidths
 - different network architectures
- ◆ different impacts on IP (& TCP)
 - Performance Implications of Link Characteristics (pile)
working group
- ◆ IP overhead may be an issue
 - robust header compression to-be WG in IETF
- ◆ TCP has a problem with the non-congestive loss
 - do separate loss notification?
- ◆ multiple application-specific QoS requirements

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Access Networks

- ◆ why assume level-3 routing in access network?
wireless cloud, ATM cloud, cable neighborhood, ...
- ◆ might a level-2 switched access network be easier?
might be needed to do some types of provider selection
- ◆ why assume a fixed IP address in a mobile node?
use name instead of address when node switches access networks