Internet Standardization

Lars Eggert

Nokia Research Center

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As a researcher, why should you care about this?

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Motivation

If you're researching Internet-related topics, where do you learn what the real current issues are?

Hint: wireless ATM is not one of them

You need to talk to operators, vendors, registrars, policy makers, regulators, etc.

(Assuming you are interested in research that could have an impact)

Where is it easy to meet these folks?

Standards bodies (IETF) + operator fora

But...

Don’t forget to think for yourself

You will talk to many folks who aren’t researchers

Their motivations are different than yours

- Often very short-term agendas
- Few can abstract out to principles
- Many are there to make money (or keep others from taking theirs)

Think hard if the “problems” you learn about pass muster

- c.f. software engineering req’s

Still...

If you're interested in what the real problems are, you'll get a glimpse

If you're interested in fixing some of them, you'll need to participate

Basic rule for extensions to existing stuff: take it to where it came from

For new stuff, pick the forum that is closest (if in doubt pick one you like)

For Internet-related topic, that means

- Mostly IETF (3GPP or ITU-T partially)
- Operator fora: NANOG, RIPE, etc.

Also...

If you're on an academic career path, standardization is unlikely to get you tenure

But it doesn't often hurt you either

You will meet likeminded people to collaborate with

And some of them have budgets

If you're not on the academic career path, getting positively noticed in these fora may lead to job offers...

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A Quick Overview of the IETF

The Internet Engineering Task Force is
a loosely self-organized group of people
who contribute to the engineering and
evolution of Internet technologies.
It is the principal body engaged in the
development of new Internet standard
specifications.

RFC4677

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The Internet Engineering Task Force – IETF

The IETF is an open, international community

- Network designers, operators, vendors and researchers

Goal: evolution of the Internet architecture and smooth operation of the Internet

Open to any interested individual

- "people, not companies"

Produces Internet standards (and other documents)

"We reject kings, presidents and voting. We believe in rough consensus and running code."

Dave Clark (1992)

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The Role & Scope of the IETF

"Above the wire and below the application"

- IP, TCP, email, routing, IPsec, HTTP FTP, SSH, LDAP
- SIP, MobileIP, PPP, RADIUS, Kerberos secure email
- Streaming video & audio
- ...

But wires are getting fuzzy

- MPLS, GMPLS, PWE3, VPN, ...

Hard to clearly define the IETF scope

- Constant exploration of the edges

"Since attendees must wear their name tags, they must also wear shirts or blouses. Pants or skirts are also highly recommended."

RFC4677, The Tao of IETF: A Novice's Guide to the Internet Engineering Task Force

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IETF by Numbers

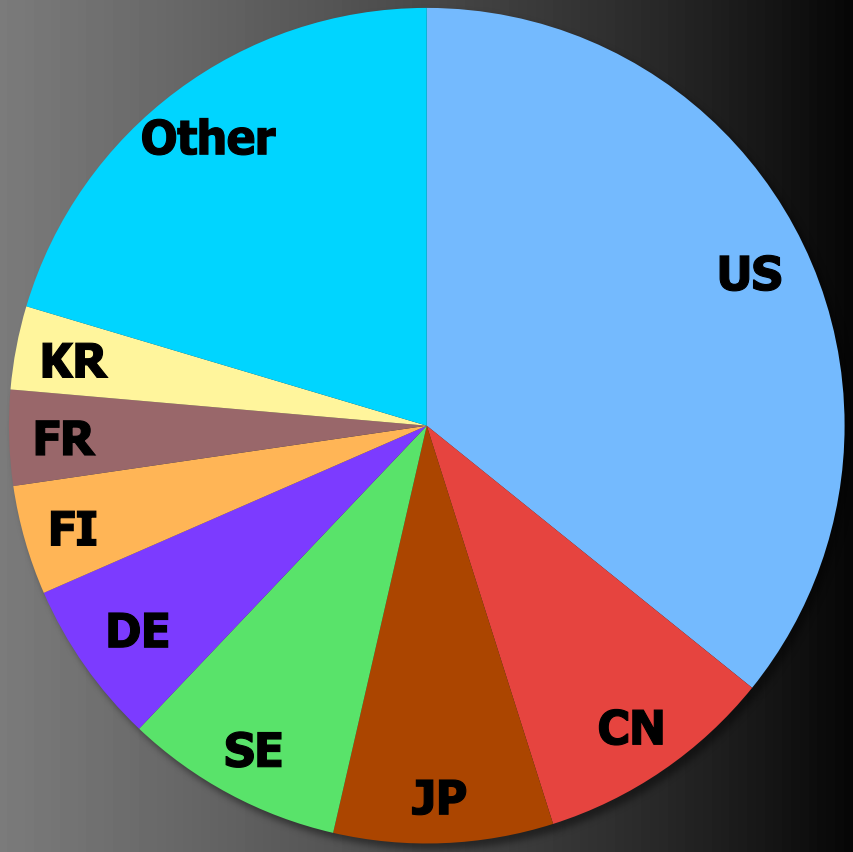
1K-2K people at 3 meetings/year
- from ca. 40-50 different countries
- Many, many more on mailing lists

~120 Working Groups (WGs)
- ~2 WG chairs each

8 Areas with 15 Area Directors (ADs)

More than 5500 RFCs published
- Internet Standards and informational documents

More than 50000 Internet Draft revisions submitted



Participants at IETF-75 Stockholm, July 2009 1084 total, 50 countries

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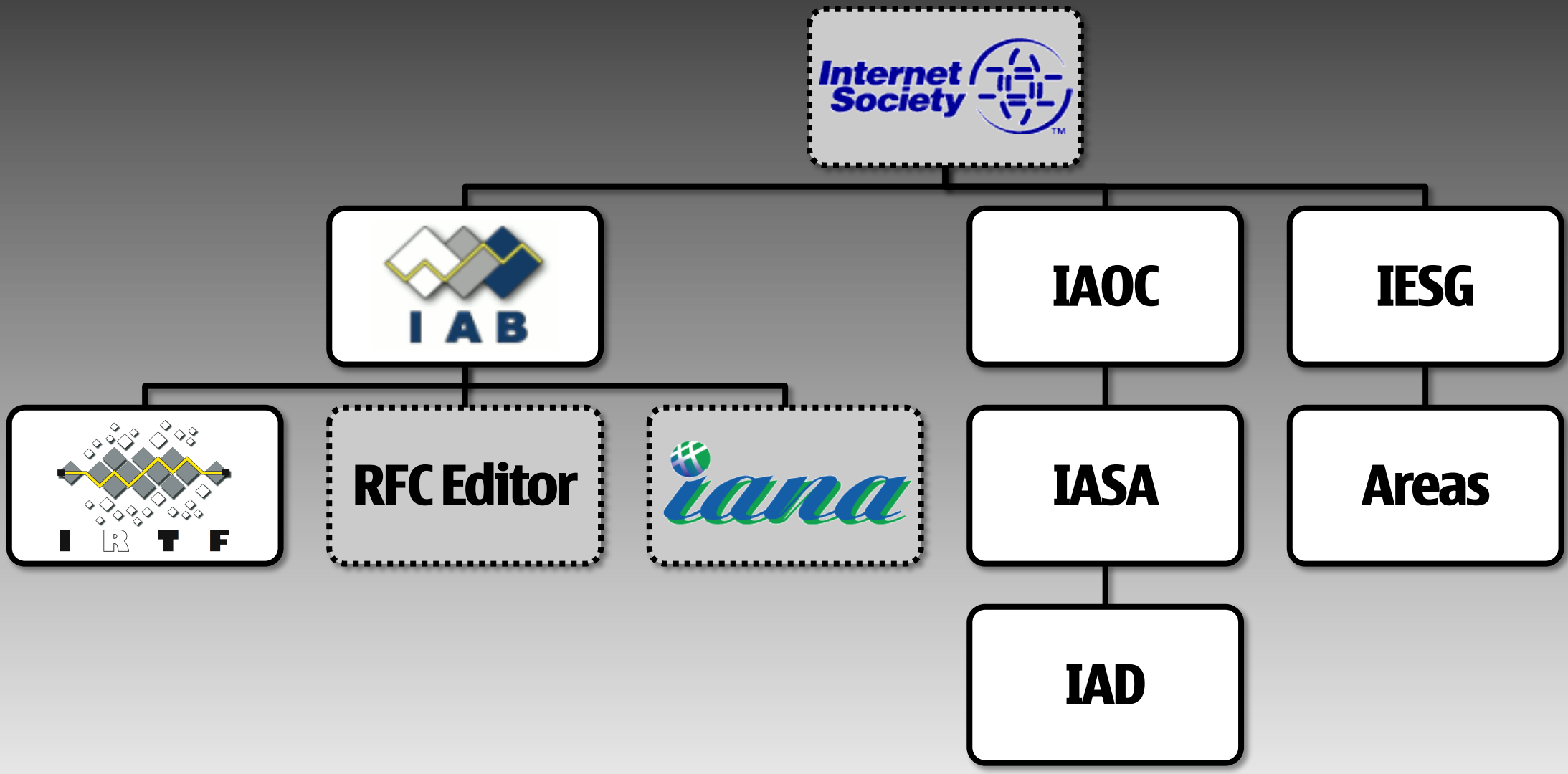
Top-Level Organizational View



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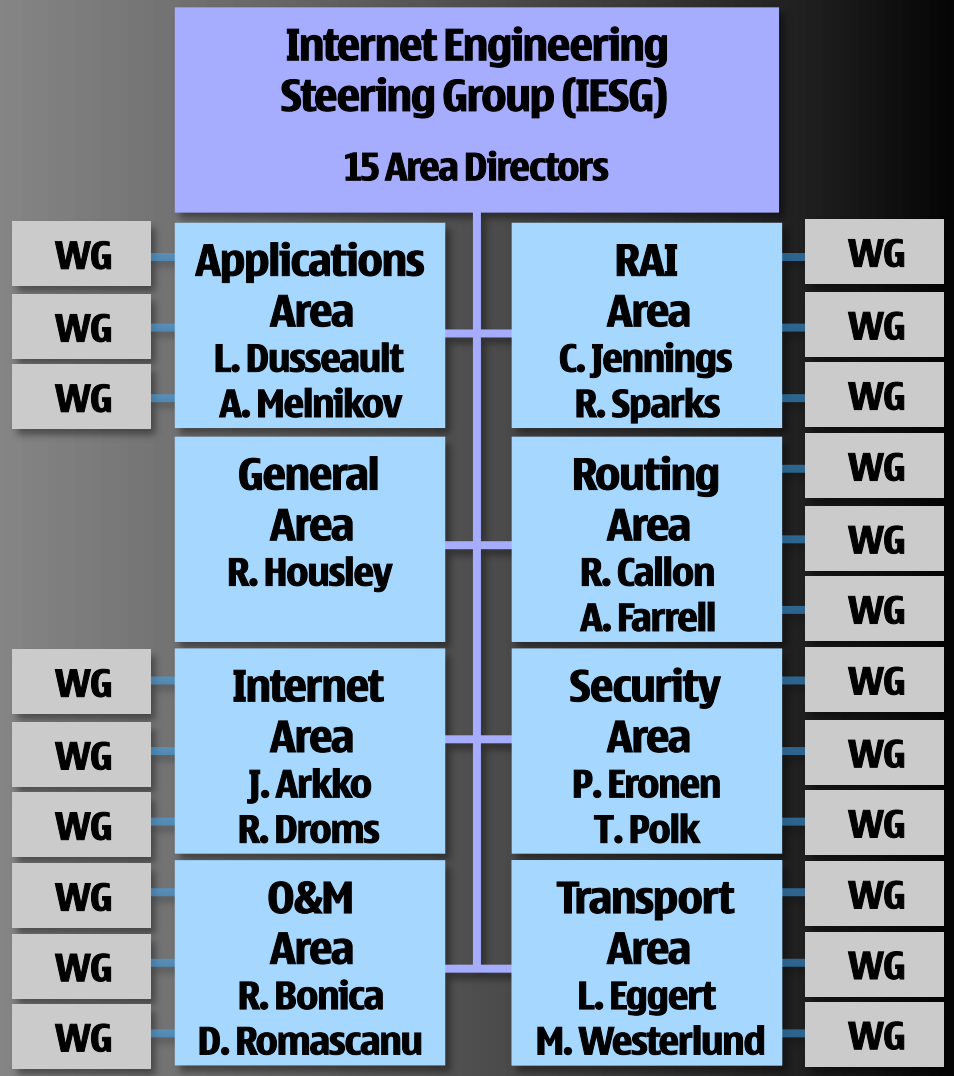
Top-Level IESG & WG Structure

IETF is structured into Areas
- Each with Area Directors (ADs)

Areas are structured into Working Groups (WGs)
- Each with WG Chairs

Internet Engineering Steering Group (IESG) = all ADs
- Approves all Internet Standards
- Manages technical work
- Starts/ends WGs
- Assigns WG Chairs



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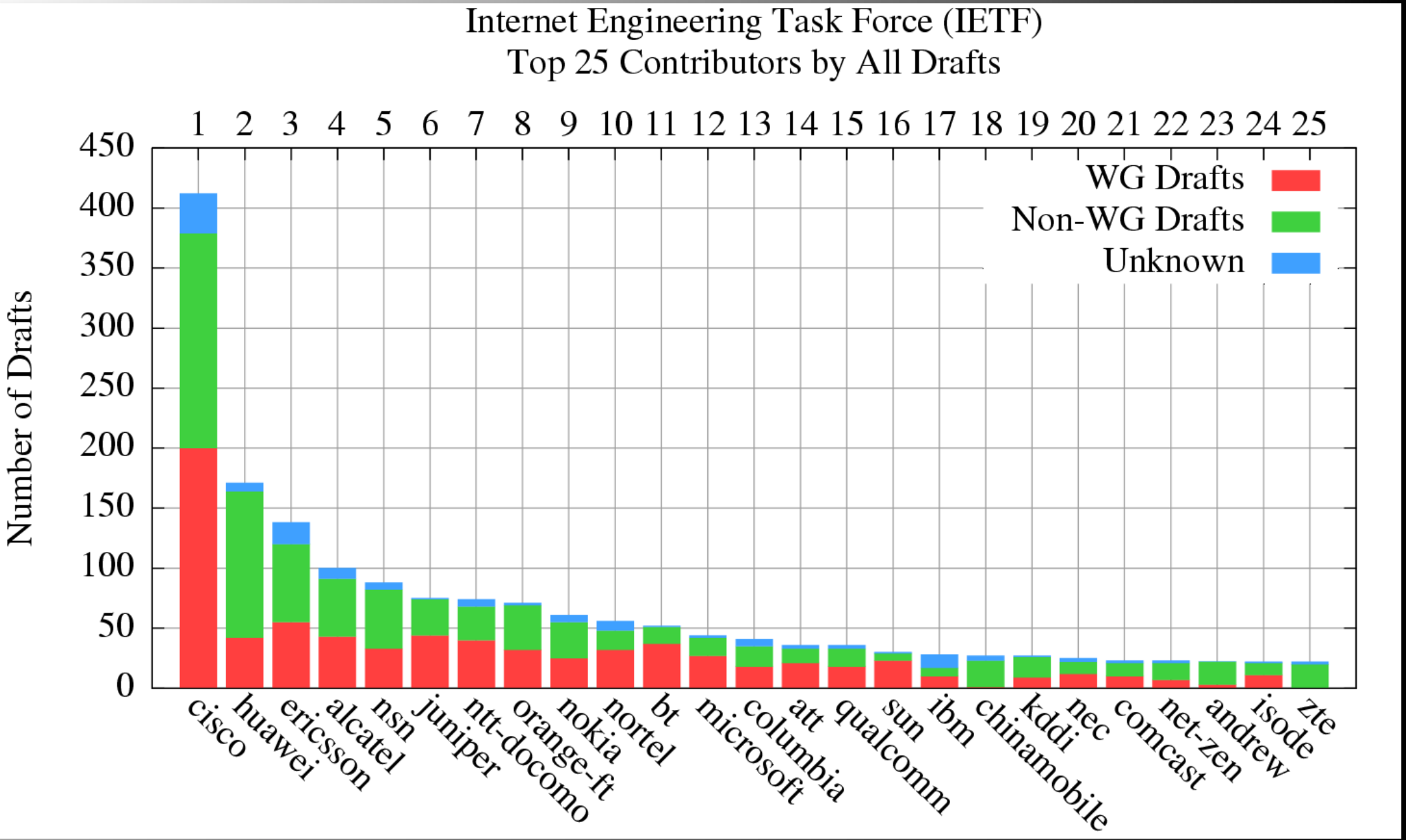
Most Active IETF Participants



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About the Different IETF Documents

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IETF Documents – Two Types

Internet Draft (ID)

Active working documents

Not finalized! Not stable!

Anyone can submit
- draft-yourname-...

Only some IDs are WG documents!
- draft-ietf-wgname-...

Request For Comment (RFC)

Archival publications
- Never change once published

Not all RFCs are standards!
- Standards track:
  - Proposed Standard
  - Draft Standard
  - Full Standard
- Other types:
  - Informational
  - Experimental
  - Best-Current-Practice (BCP)

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IETF Document Format

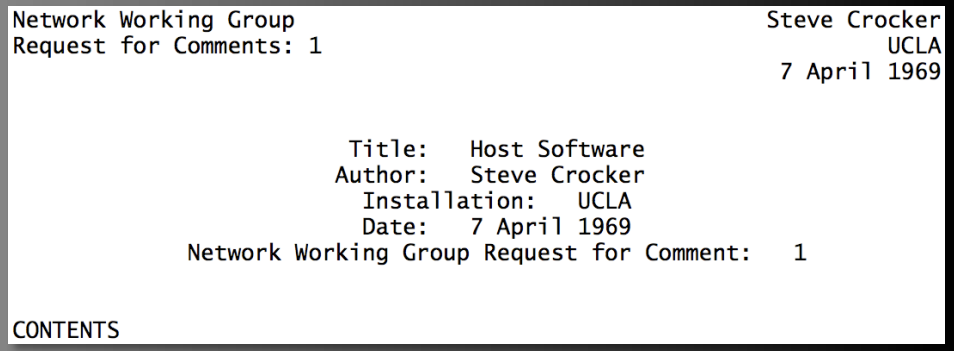
English if the official language of the IETF; ASCII is the mailing list and document format

Various tools exits (xml2rfc, etc.)

Constant discussion of alternate formats

- IETF seen as “behind the times”
- (Almost) no drawings
- But no consensus on alternative

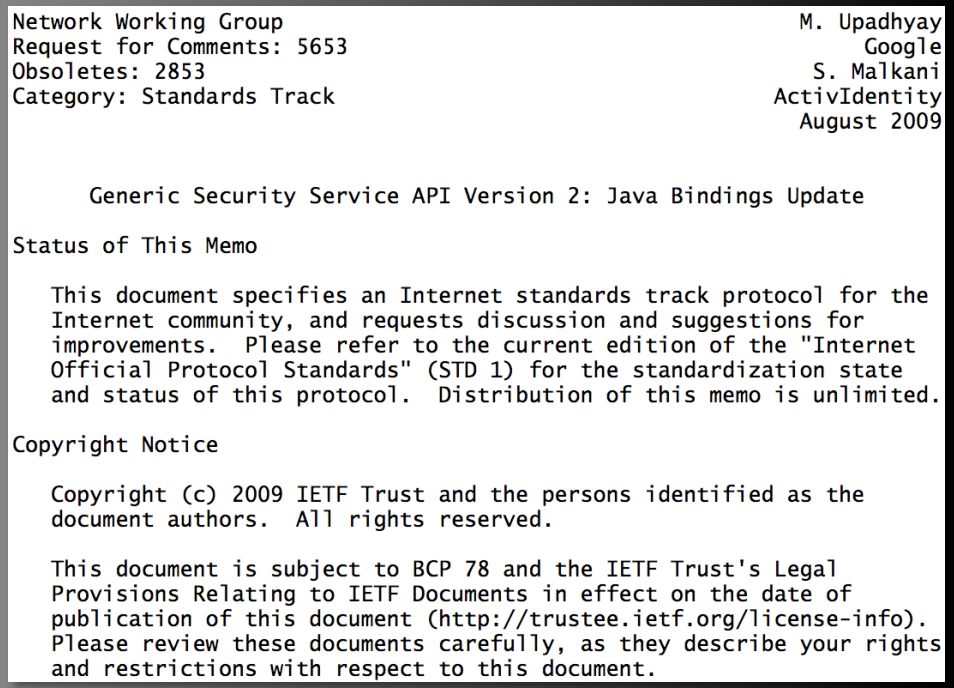
Note that the current format is still readable after 40+ years...



```
Network Working Group                                          Steve Crocker
Request for Comments: 1                                             UCLA
                                                                7 April 1969


                          Title:    Host Software
                         Author:    Steve Crocker
                       Installation:    UCLA
                           Date:    7 April 1969
              Network Working Group Request for Comment:    1


CONTENTS
```



```
Network Working Group                                          M. Upadhyay
Request for Comments: 5653                                          Google
Obsoletes: 2853                                                S. Malkani
Category: Standards Track                                     ActivIdentity
                                                                August 2009


      Generic Security Service API Version 2: Java Bindings Update

Status of This Memo

   This document specifies an Internet standards track protocol for the
   Internet community, and requests discussion and suggestions for
   improvements.  Please refer to the current edition of the "Internet
   Official Protocol Standards" (STD 1) for the standardization state
   and status of this protocol.  Distribution of this memo is unlimited.

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   Please review these documents carefully, as they describe your rights
   and restrictions with respect to this document.
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The IETF Organizational Structure

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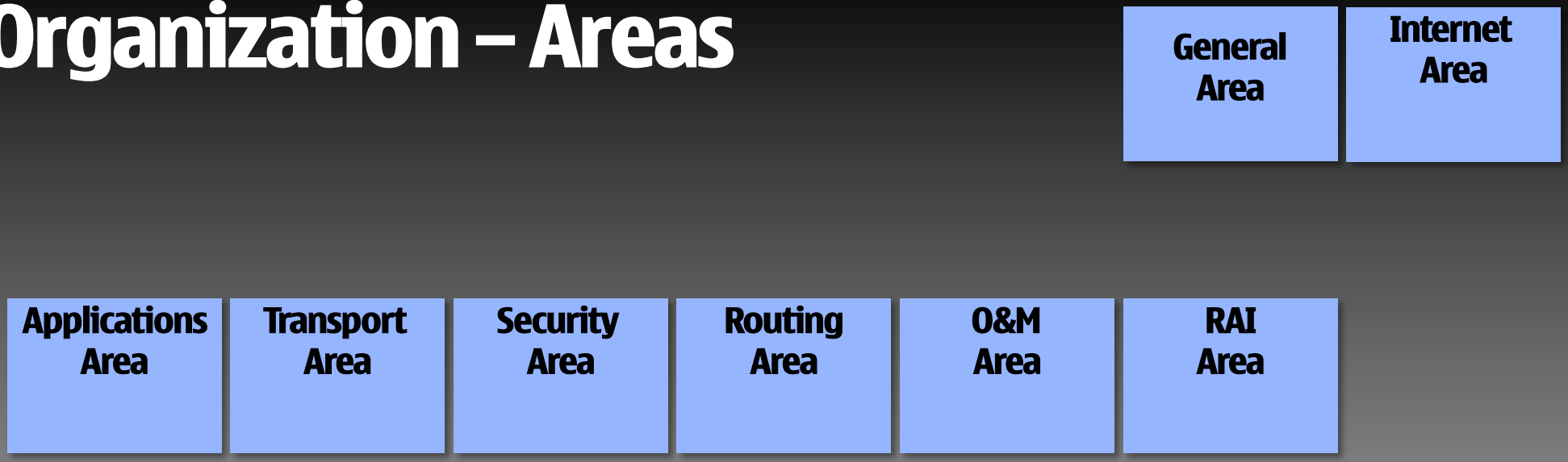
IETF Organization – Areas



8 Areas to structure the technical work:

Applications	(APP)
Transport Services	(TSV)
Security	(SEC)
Routing	(RTG)
Operations & Management	(O&M)
Real-Time Applications and Infrastructure	(RAI)
Internet	(INT)
General	(GEN)

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IETF Organization – ADs

General Area	Internet Area
R. Housley	J. Arkko R. Droms

Applications Area	Transport Area	Security Area	Routing Area	O&M Area	RAI Area
L. Dusseault A. Melnikov	L. Eggert M. Westerlund	P. Eronen T. Polk	R. Callon A. Farrell	R. Bonica D. Romascanu	C. Jennings R. Sparks

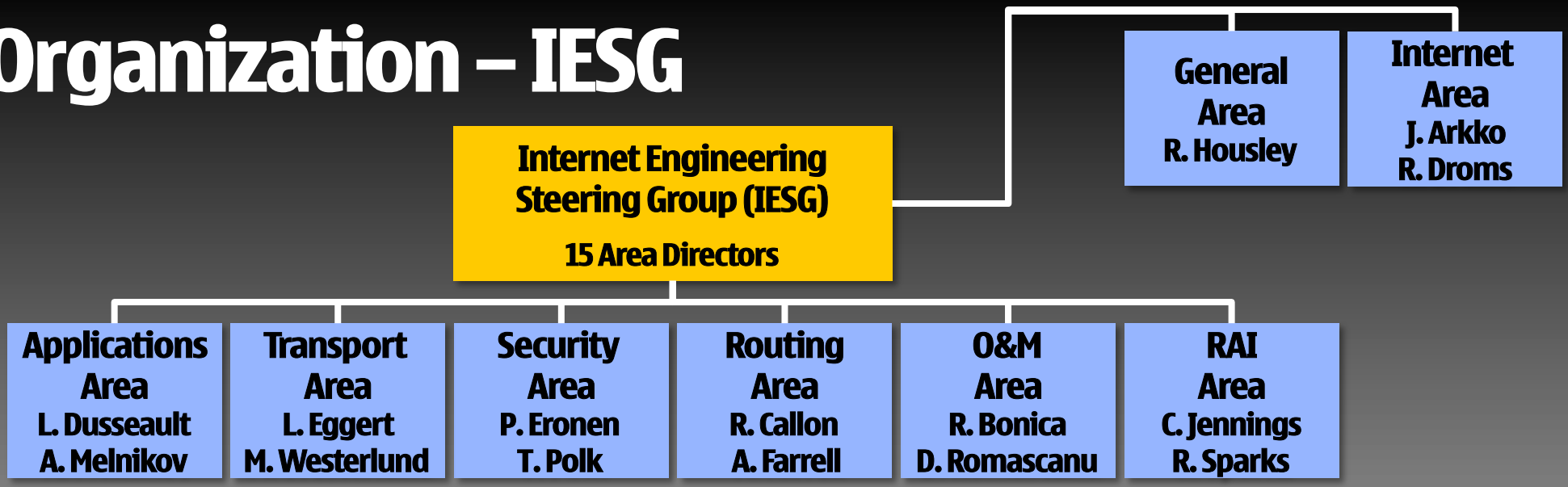
Area Directors (ADs)

- Each Area has 2, except for the General Area

ADs are responsible for:

- Setting direction in their Area
- Managing process in their Area
  - Starting and closing Working Groups (WGs)
  - Approving the scope of technical work
- Reviewing Working Group documents

IETF Organization – IESG



Internet Engineering Steering Group (IESG)

- Formed by all 15 ADs

The IESG is the process management and RFC approval body

- Approves all WG creations
- Provides technical review
- Approves publication of IETF documents
- Reviews and comments on non-IETF submissions

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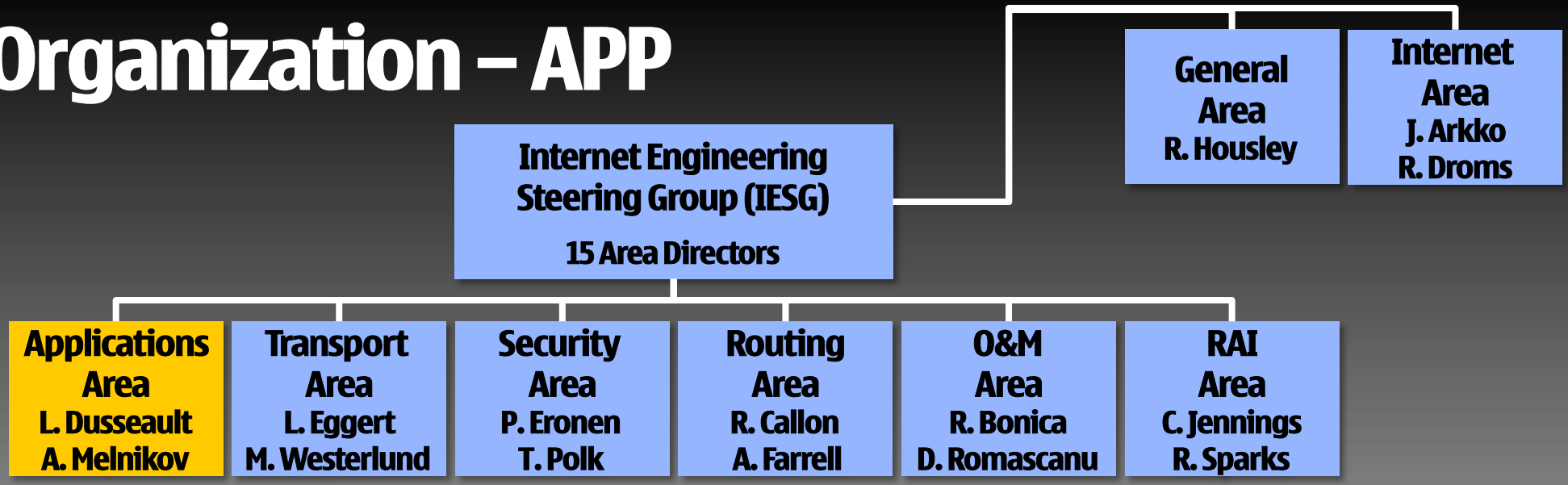
IETF Organization – APP

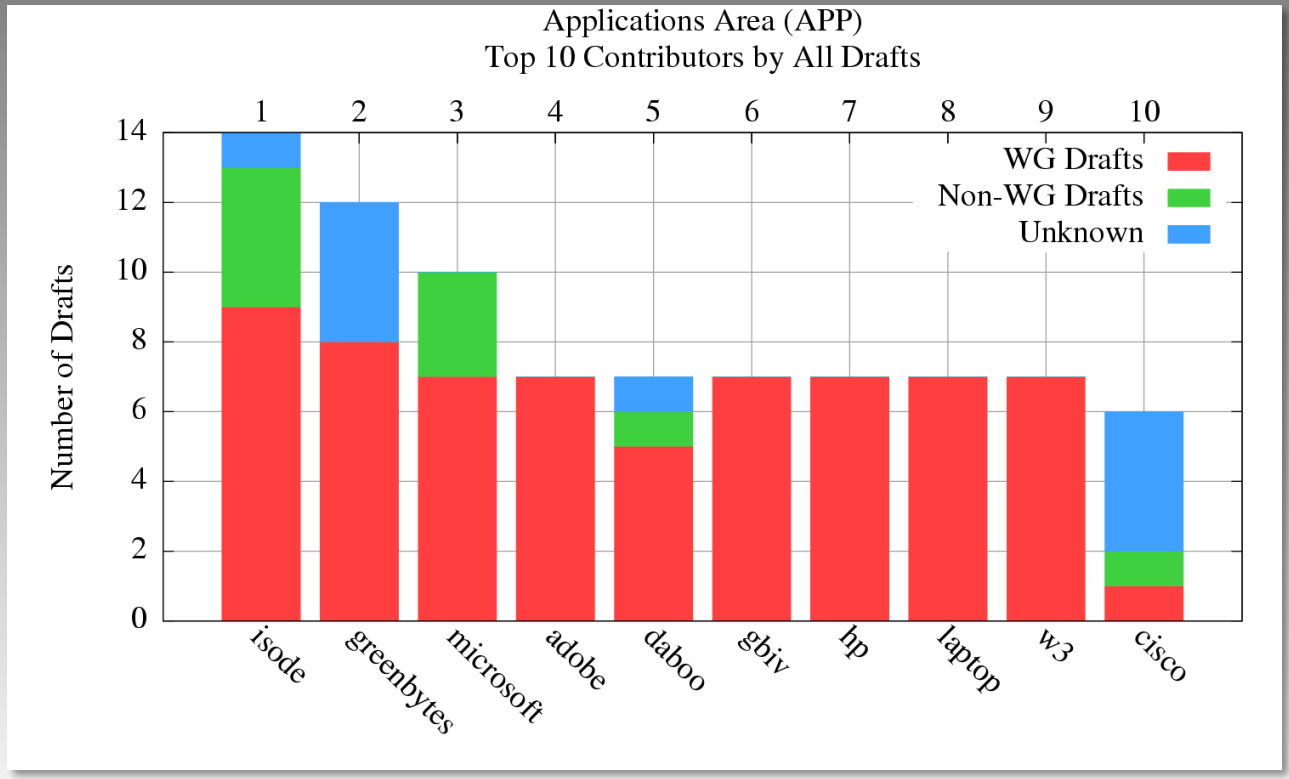


Applications Area (APP)

Focus on applications and application-layer protocols

Current work items:

- Email, calendaring, web
- Directories, registries
- Internationalization



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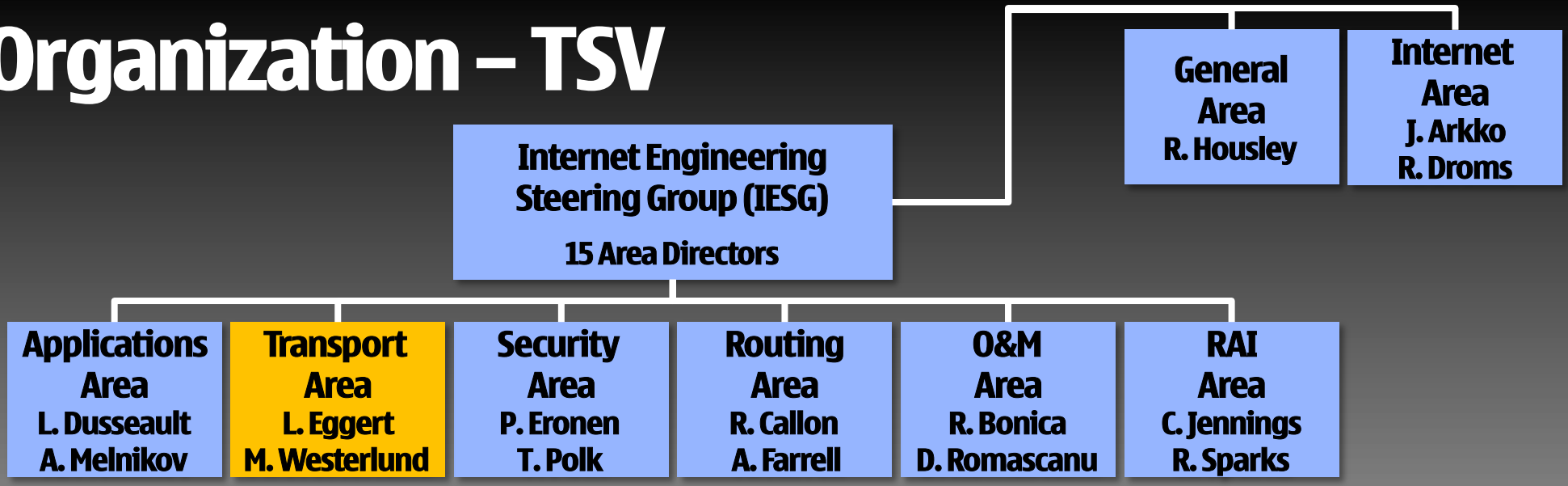
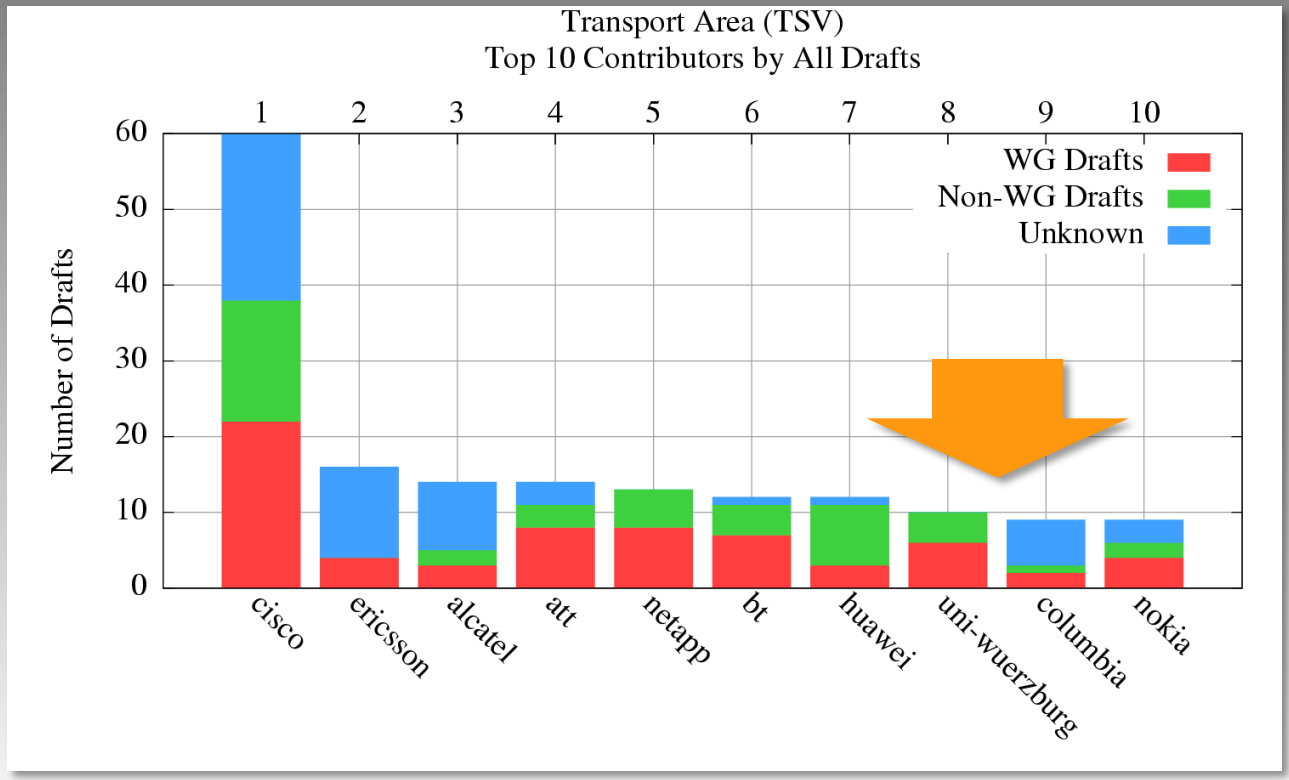
IETF Organization – TSV



Transport Area (TSV)

Focus on layer-4 transport protocols and services

- TCP, UDP, SCTP, DCCP
- Congestion control
- Multicast, signaling
- NAT regularization
- IP storage and NFS



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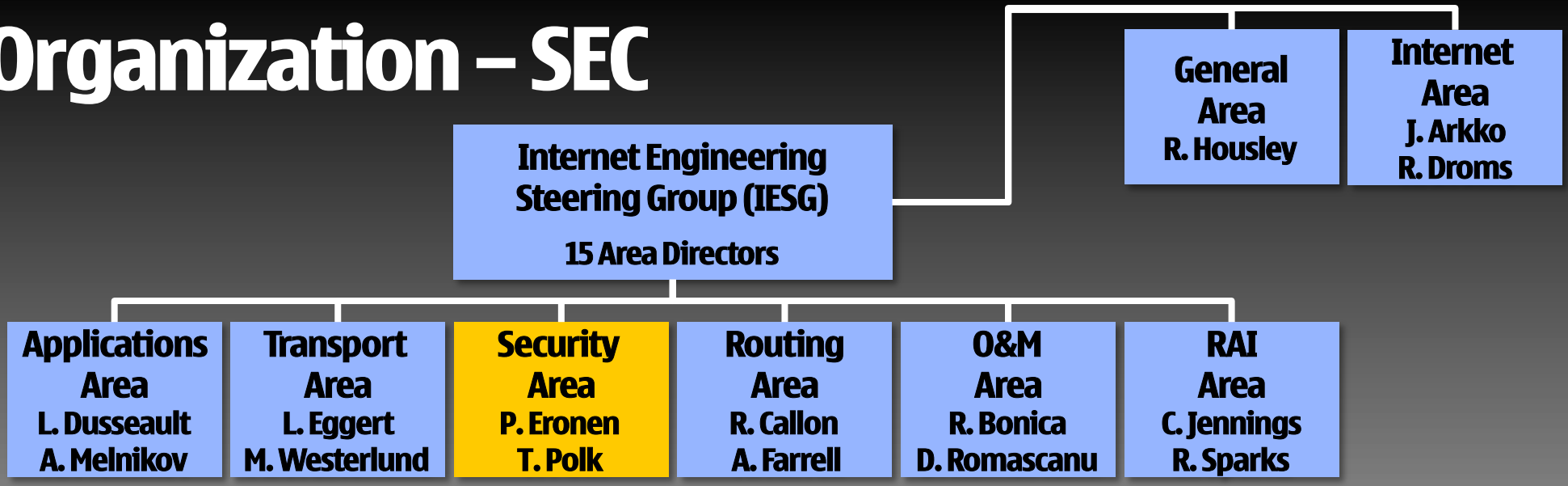
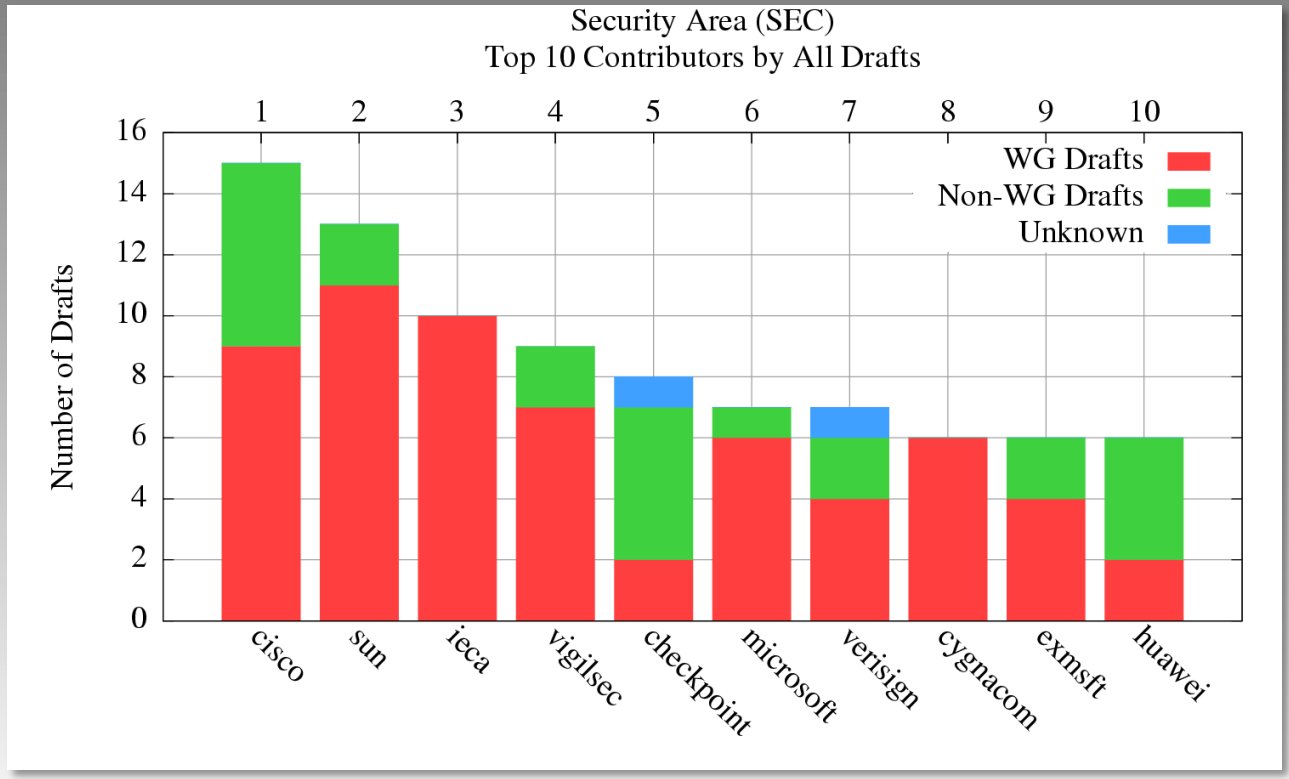
IETF Organization – SEC



Security Area (SEC)

Focus on security protocols and services for integrity, authentication, non-repudiation, confidentiality and access control

- IPsec, TLS
- Kerberos, SASL
- S/MIME



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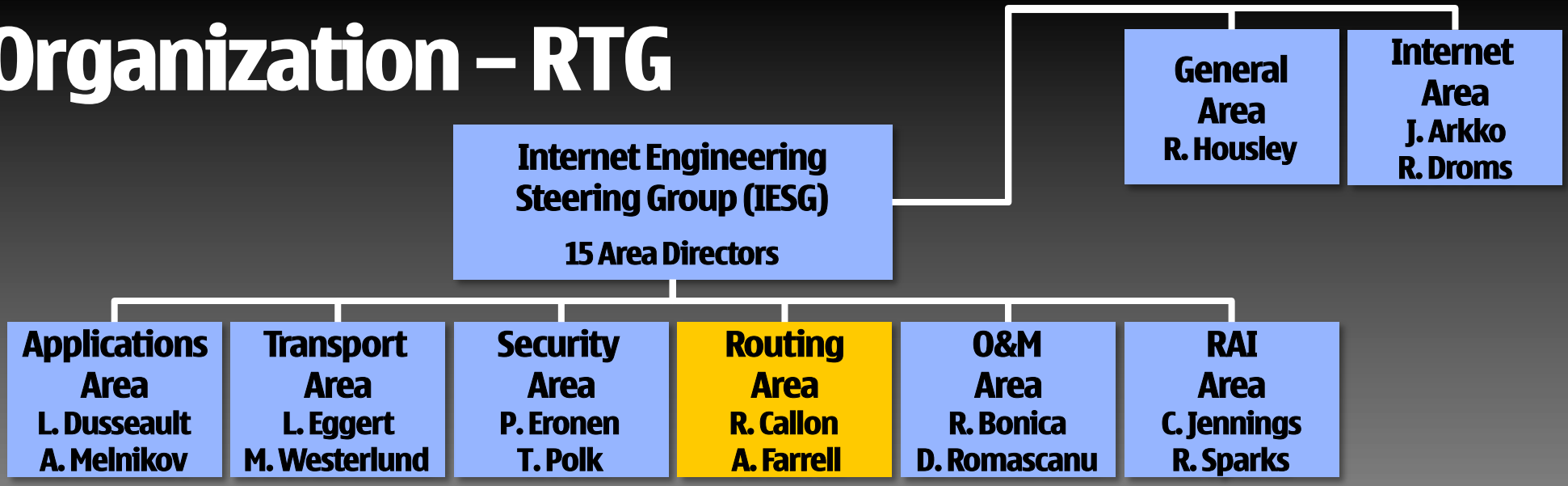
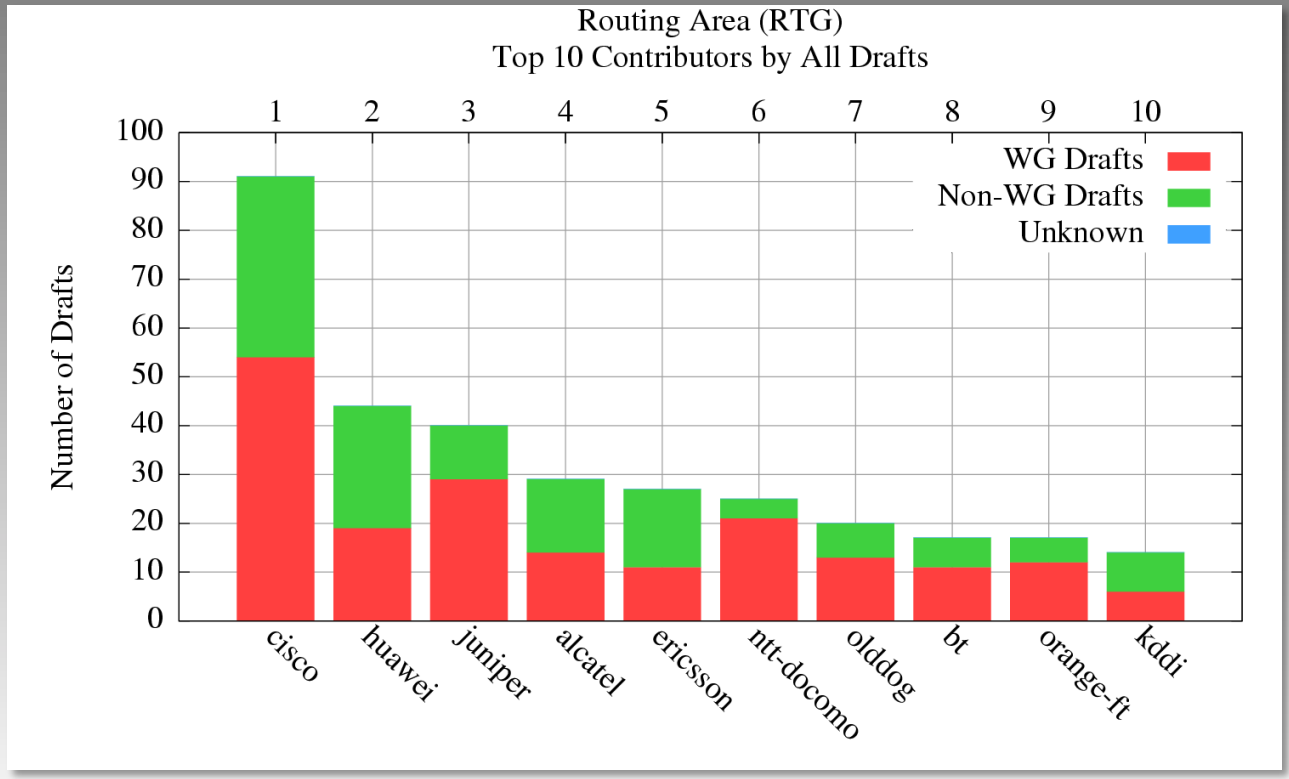
IETF Organization – RTG



Routing Area (RTG)

Focus on layer-3 routing protocols

- Forwarding for unicast, multicast and MPLS
- Routing and signaling protocols (OSPF, IS-IS, BGP), MPLS
- Routing security



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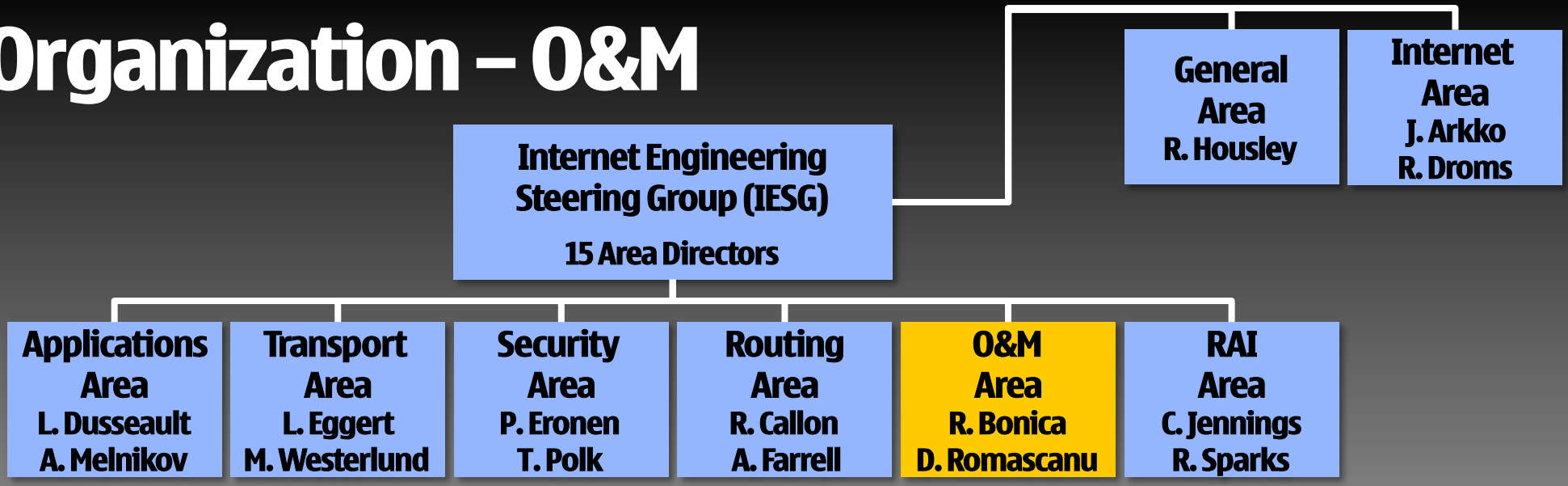
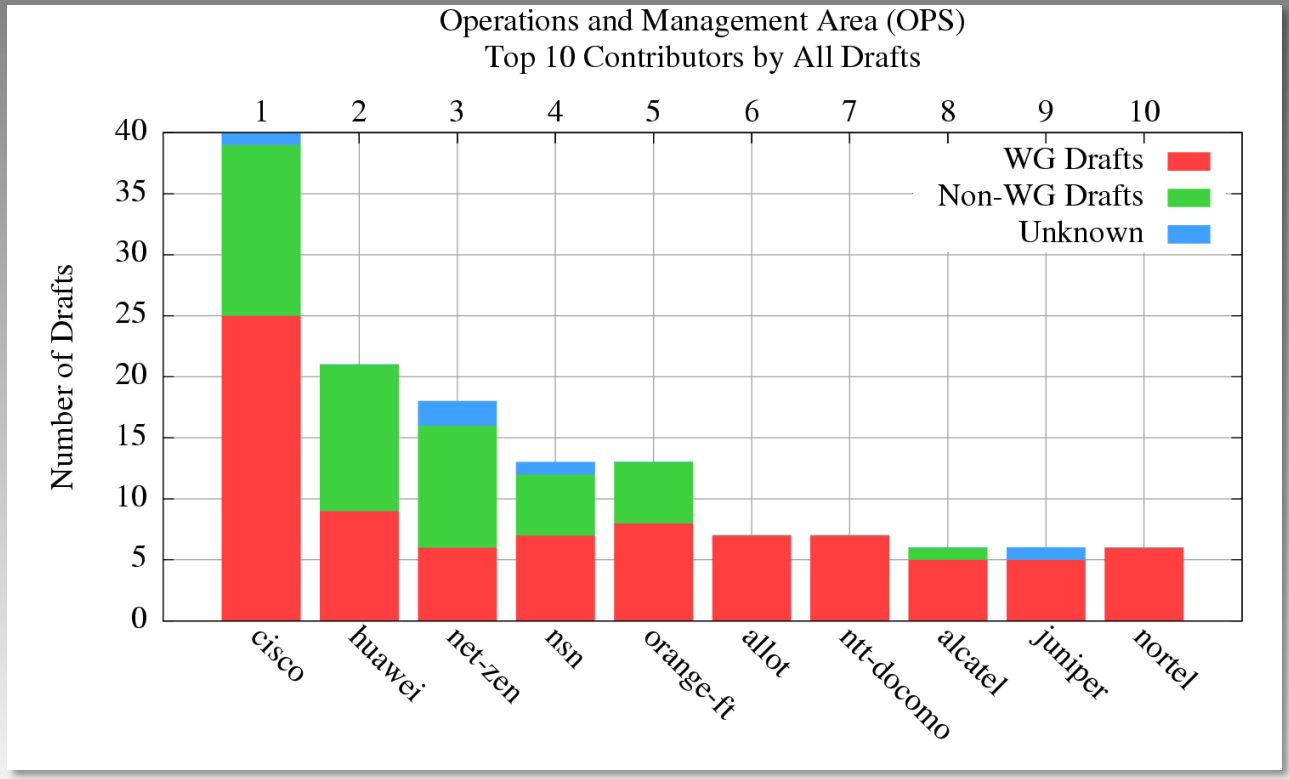
IETF Organization – O&M



Operations and Management Area (O&M)

Focus on network management and operation

- AAA, DNS, IPv6 & routing operations
- Management (SNMP, NetConf, CAPWAP)



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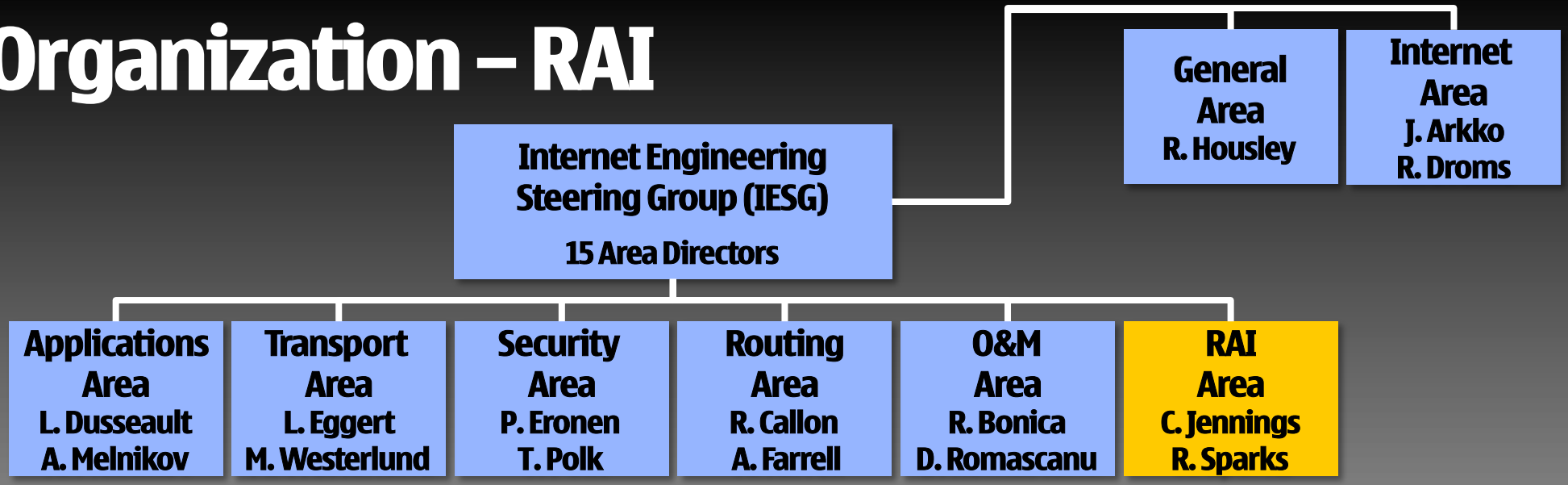
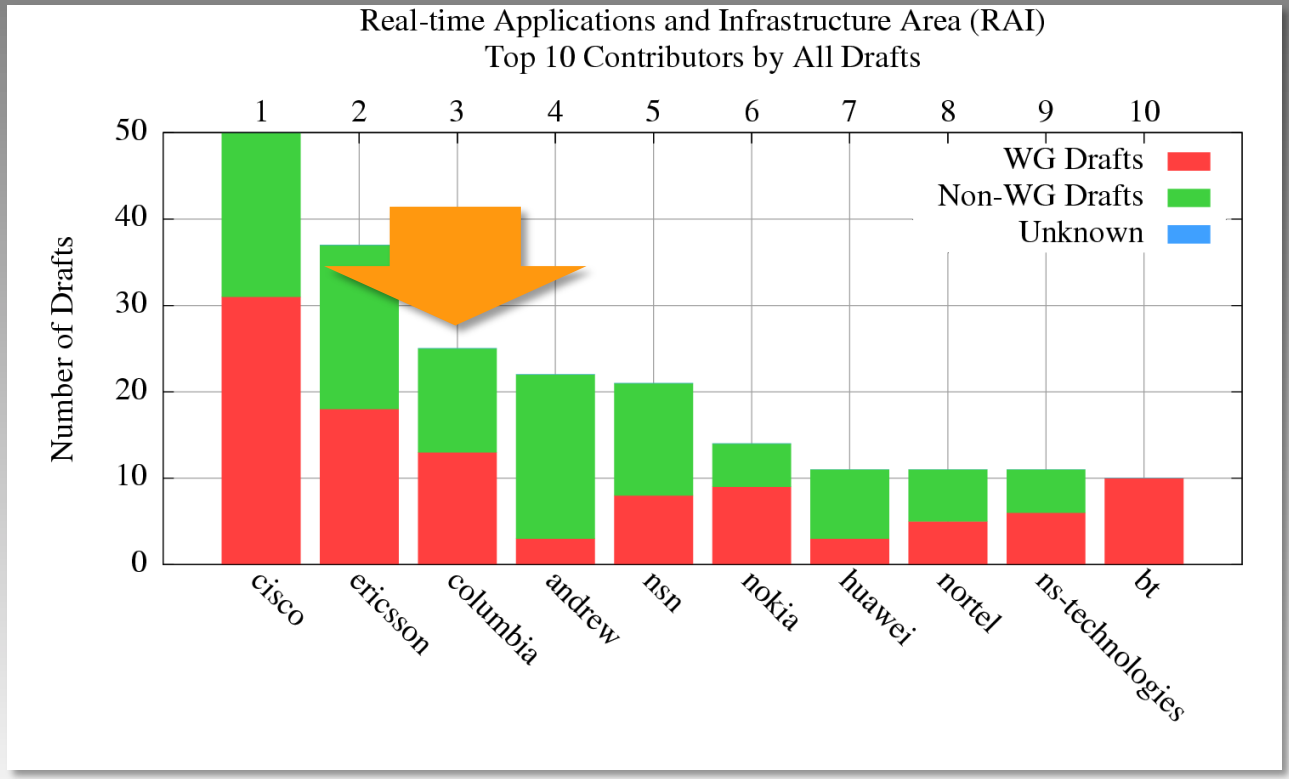
IETF Organization – RAI



Real-Time Applications & Infrastructure Area (RAI)

Focus on delay-sensitive applications + services

- Voice & video over IP
- Instant messaging and presence
- SIP and RTP
- IP telephony & services



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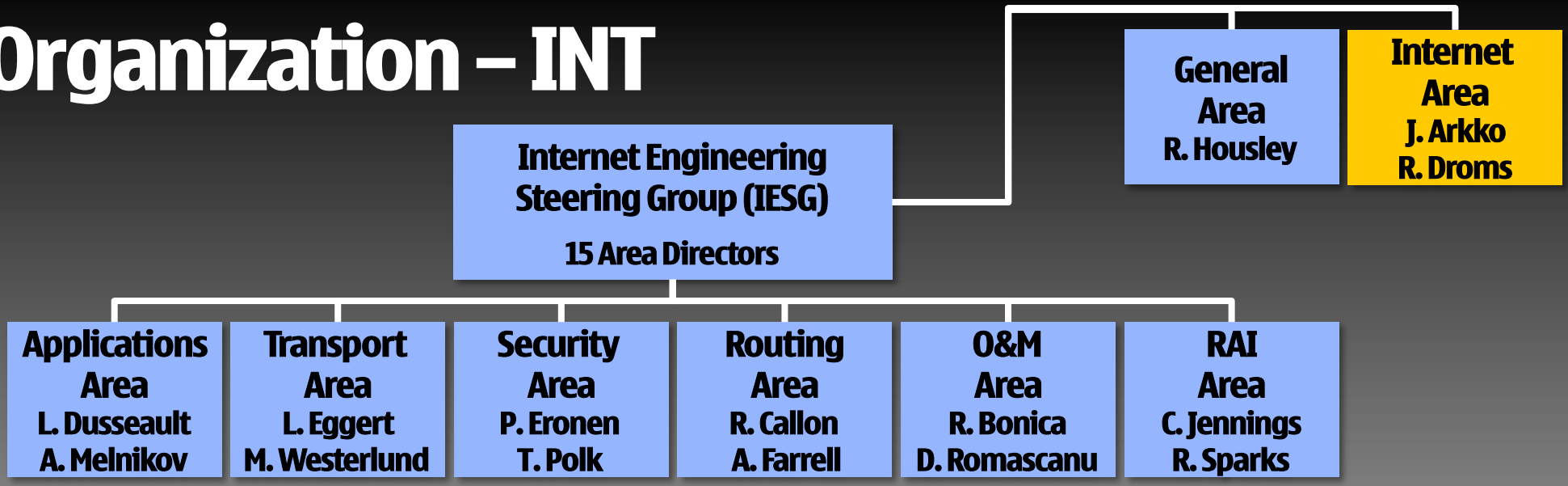
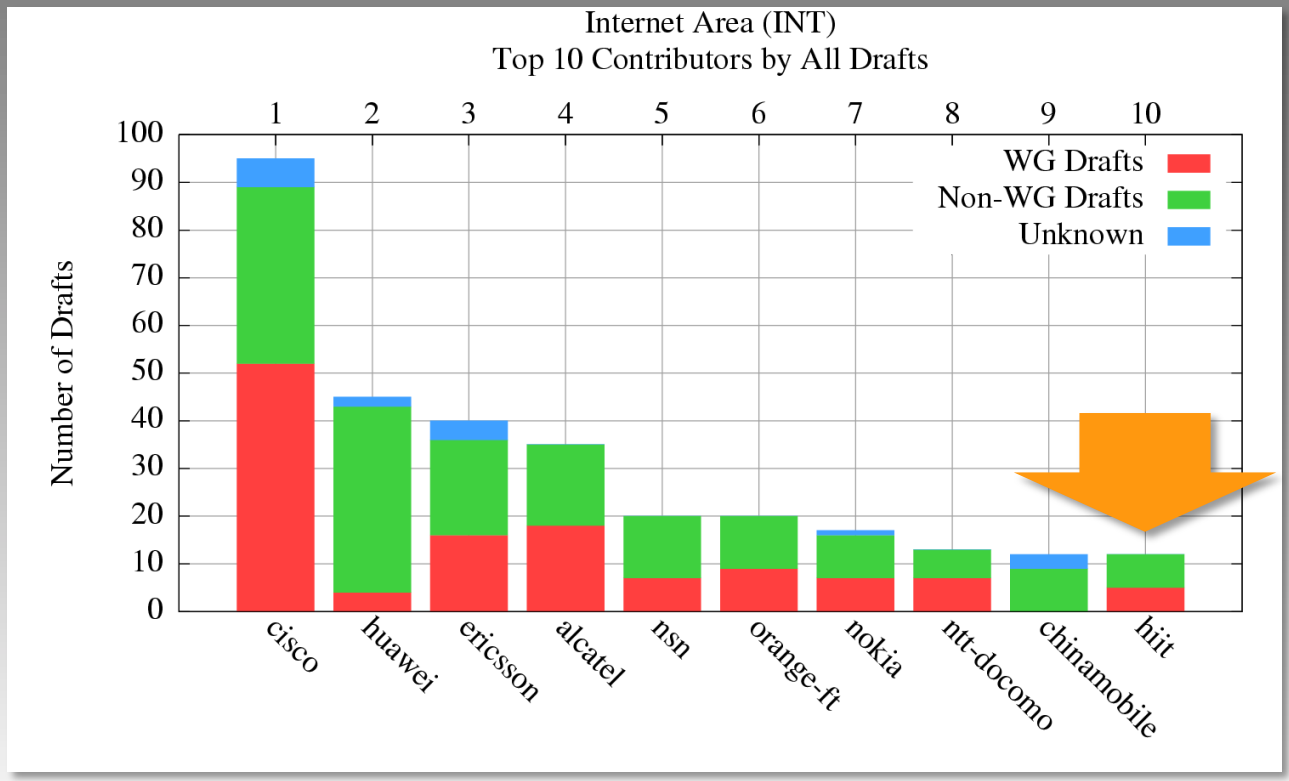
IETF Organization – INT



Internet Area (INT)

Focus on layer-3 architecture and protocols

- IPv4 and IPv6
- VPNs and MPLS
- DNS and DHCP
- Mobility & multihoming
- Network access control



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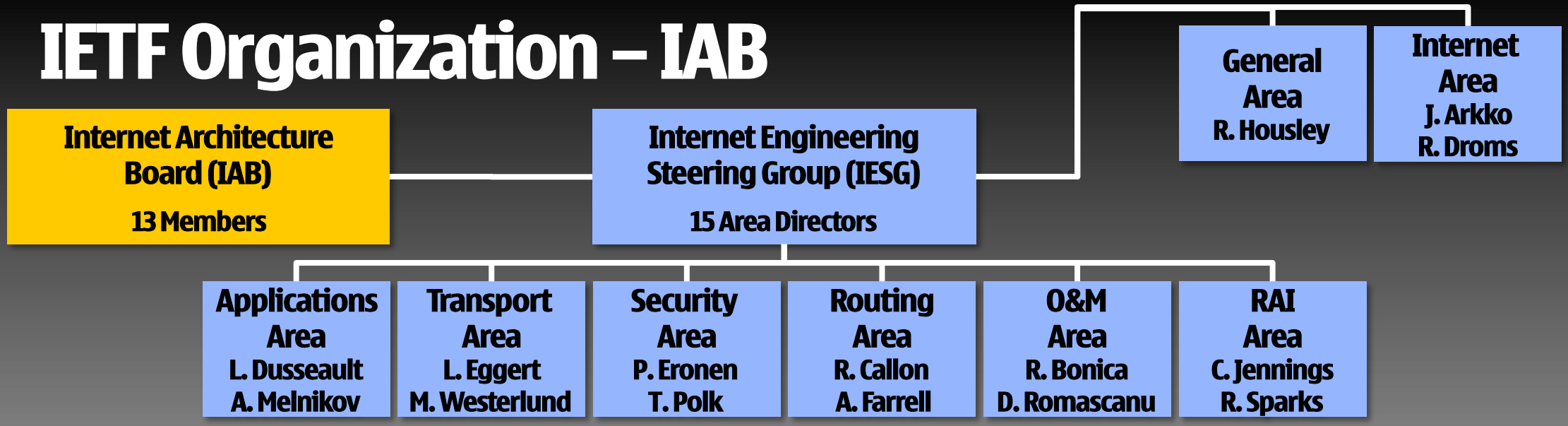
IETF Organization – IAB



Internet Architecture Board (IAB)

IAB provides overall architectural advice & oversight

- Provides “oversight” of IETF standards process
- Deals with IETF external liaisons to other SDOs
- Sponsors the Internet Research Task Force (IRTF)
- Write documents stating the IAB’s technical opinion
- Community & IESG review
- Participate in WG discussions

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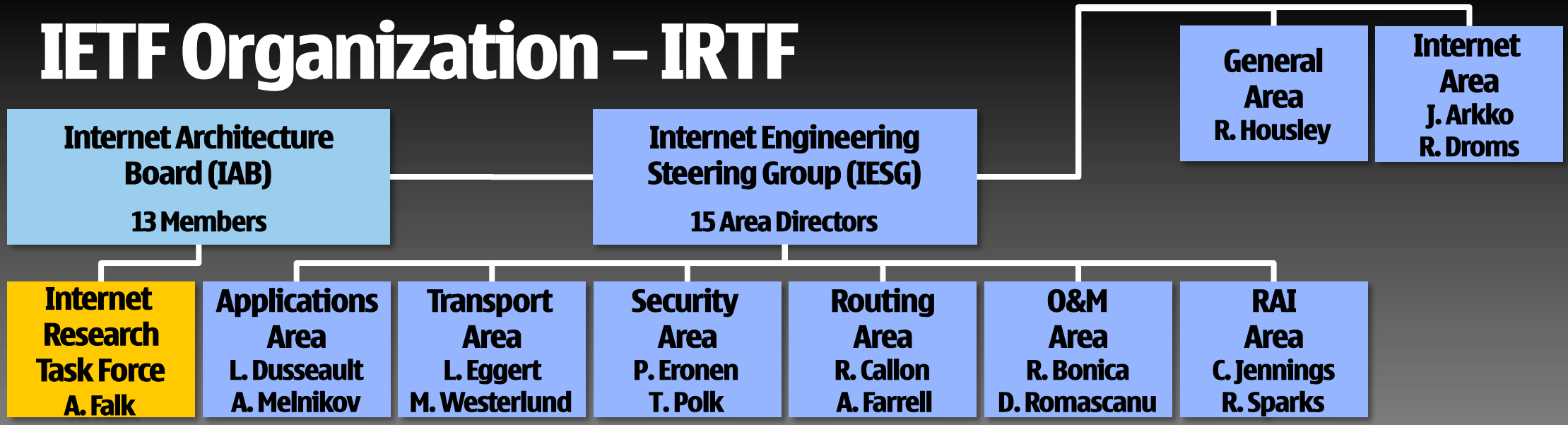
IETF Organization – IRTF



Internet Engineering Research Task Force (IRTF)

Focused on long-term research problems in Internet

Anti-Spam	(ASRG)		
Crypto Forum	(CFRG)		
Delay-Tolerant Networking	(DTNRG)		
End-to-End	(END2END)	Peer-to-Peer	(P2PRG)
Host Identity Protocol	(HIPRG)	Public Key Next-Generation	(PKNG)
Internet Congestion Control	(ICCRG)	Routing	(RRG)
IP Mobility Optimizations	(MOBOPTS)	Transport Modeling	(TMRG)
Network Management	(NMRG)	Scalable Adaptive Multicast	(SAMRG)

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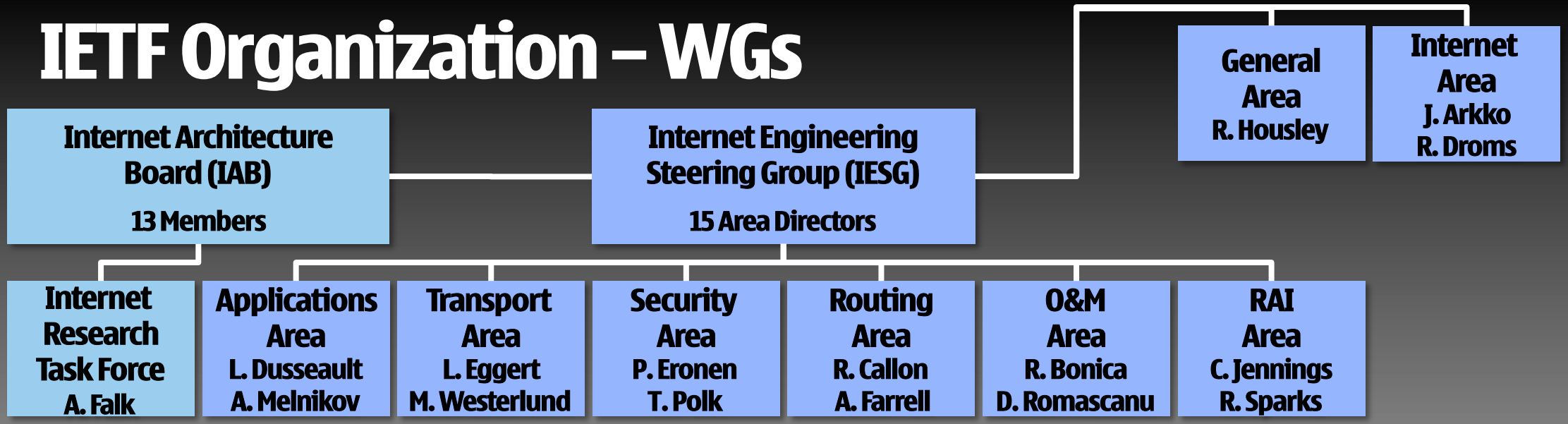
IETF Organization – WGs



Where the IETF get its work done; belong to one Area

- Discussions on mailing list + meetings focused on key issues (ideally)

WG is focused by charter agreed between WG Chairs and ADs

- Restrictive charters with milestones – WGs close when their work is done
- No defined membership, just participants

"Rough consensus and running code"

- No formal voting - cannot define constituency
- Consensus does not require unanimity; disputes resolved by discussion

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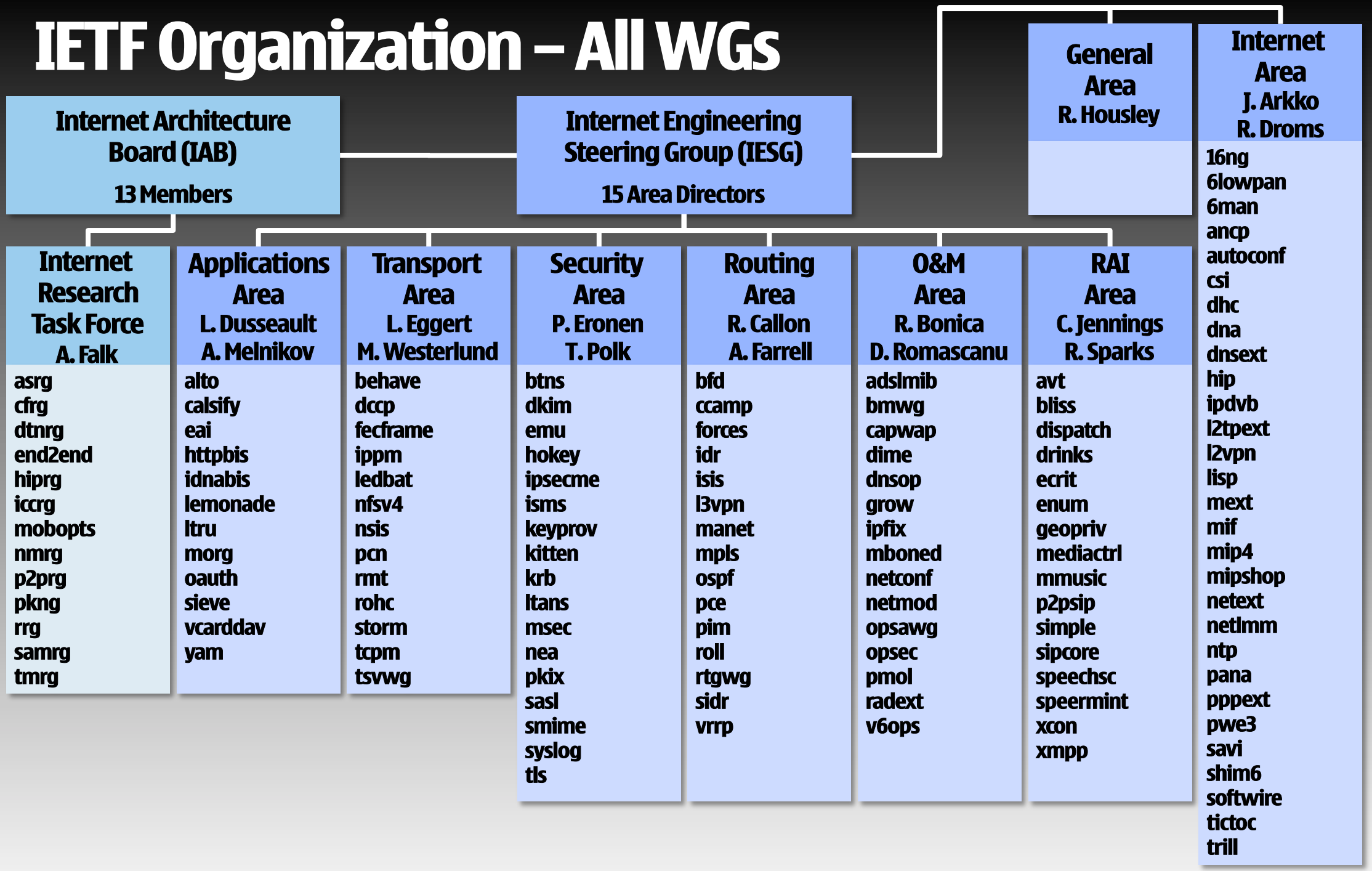
IETF Organization – All WGs



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So how do you contribute your research to the IETF?

Two cases – depends on whether your work fits into an existing WG or not

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Initiating New IETF Work – Existing WG

Check WG charters & approach chairs to ask their opinion

Submit an ID to the WG

- Read RFC5378 (IPR + copyright)
- draft-yourname-wgname-topic-00

Ask for feedback on ID on WG mail list

Ask for time during an IETF meeting

Constructively incorporate feedback ("revise quickly, revise often")

Eventually, ask to adopt as WG draft

Continue work in WG

- Note: you now become editor

WG and IESG Process

Chair establishes consensus then requests publication of ID as RFC

ID review by responsible AD

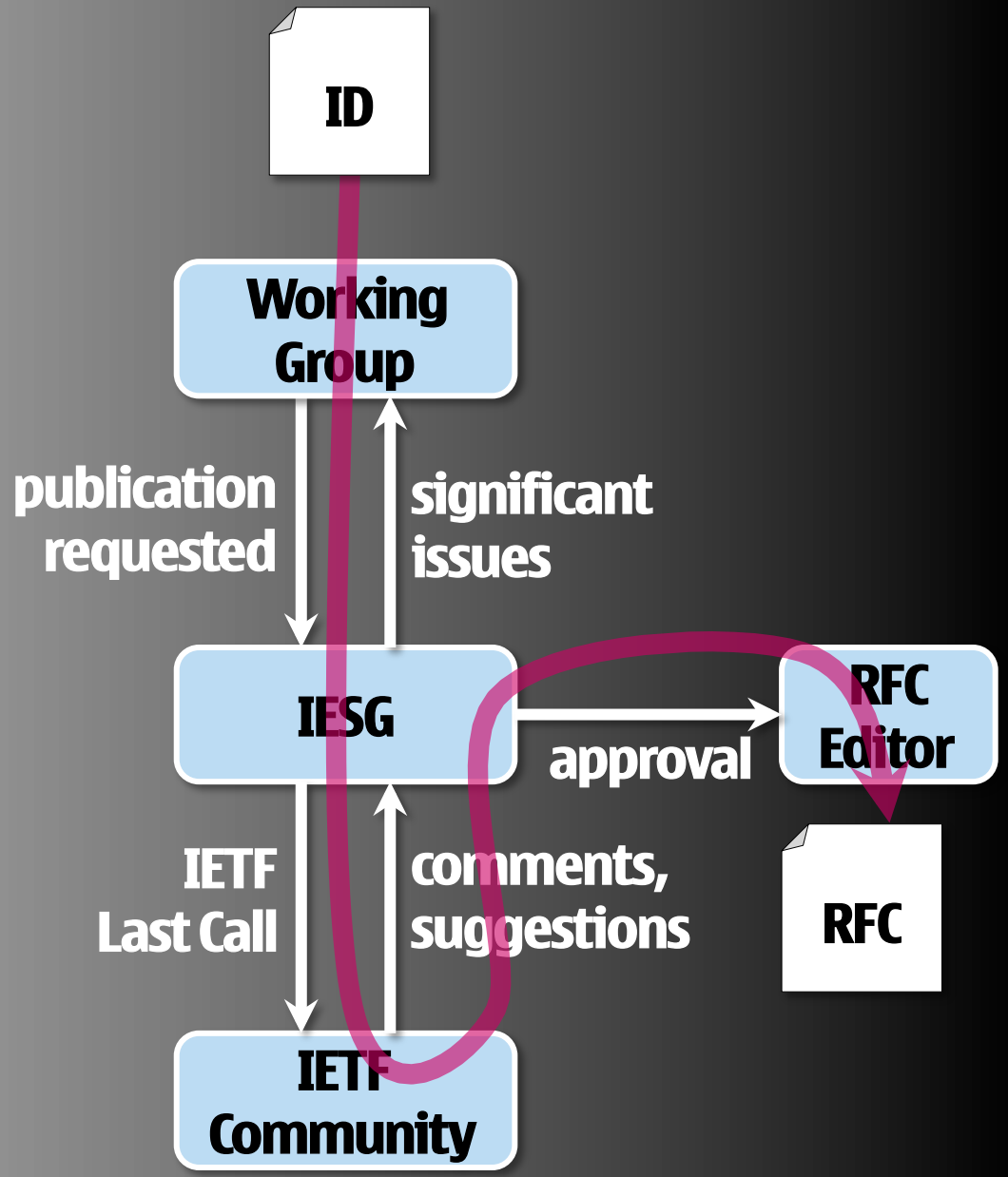
- Can be sent back to WG

IETF-wide "Last Call"

IESG review

- Last Call comments & own technical review
- Can be sent back to WG

IESG approval followed by publication as RFC



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How does this look in practice?

Some examples

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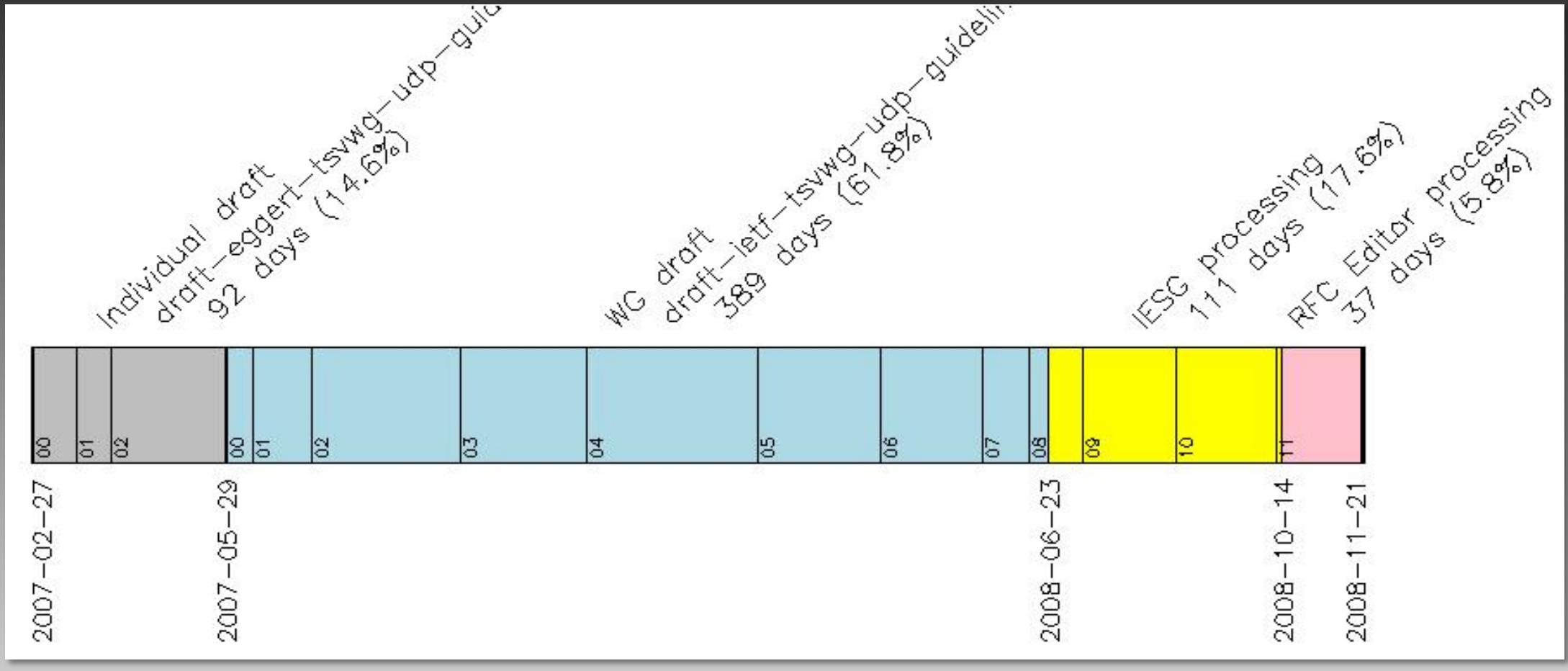
RFC 5405 (UDP Guidelines)



Document was in individual and WG process for 481 days, and in IESG/RFC Editor process for 148 days, 629 days in total.

This is 1 years and 8 months.

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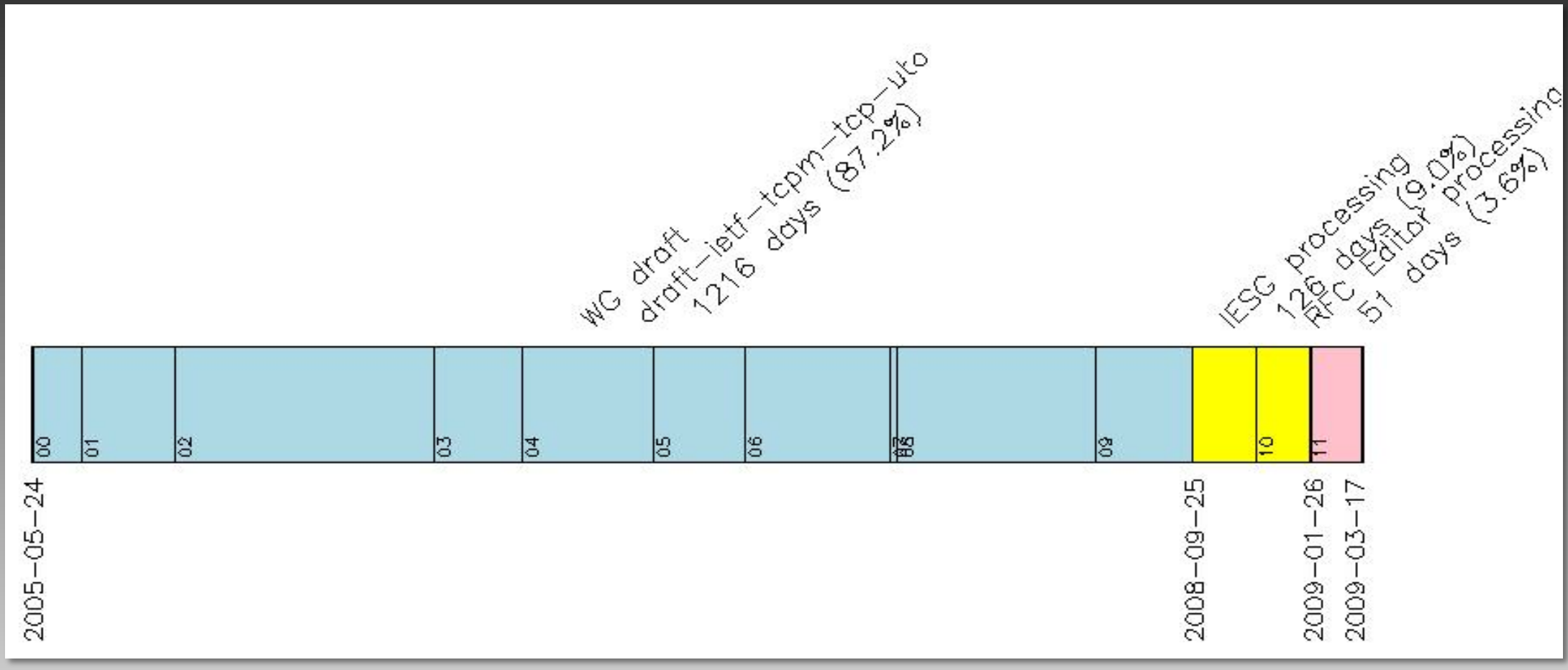
RFC 5482 (TCP User Timeout)



Document was in WG process for 1216 days, and in IESG/RFC Editor process for 177 days, 1393 days in total.

This is 3 years and 9 months. (And doesn't include pre-WG time.)

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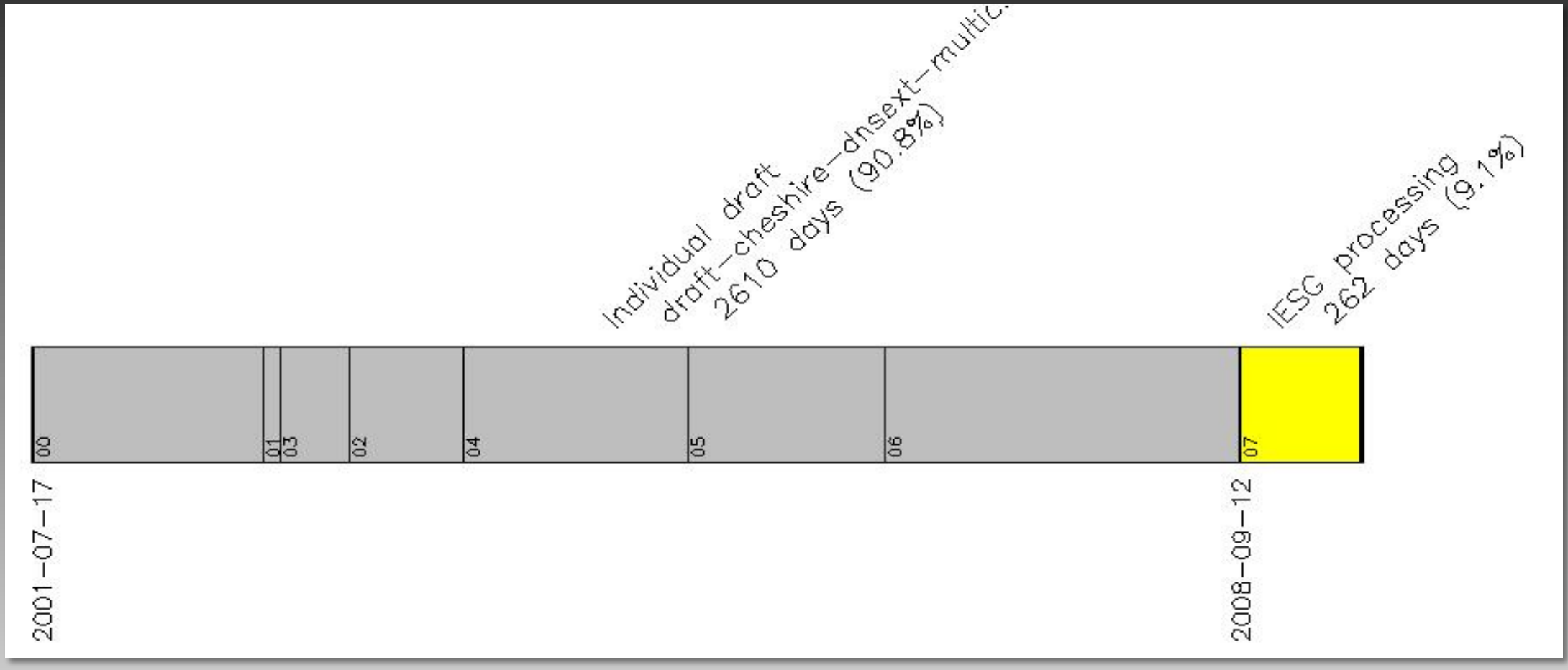
draft-cheshire-dnsext-multicastdns (Bonjour)



Document was in individual process for 2610 days, and in IESG/RFC Editor process for 262 days, 2872 days in total.

This is 7 years and 10 months. (And it's not published yet...)

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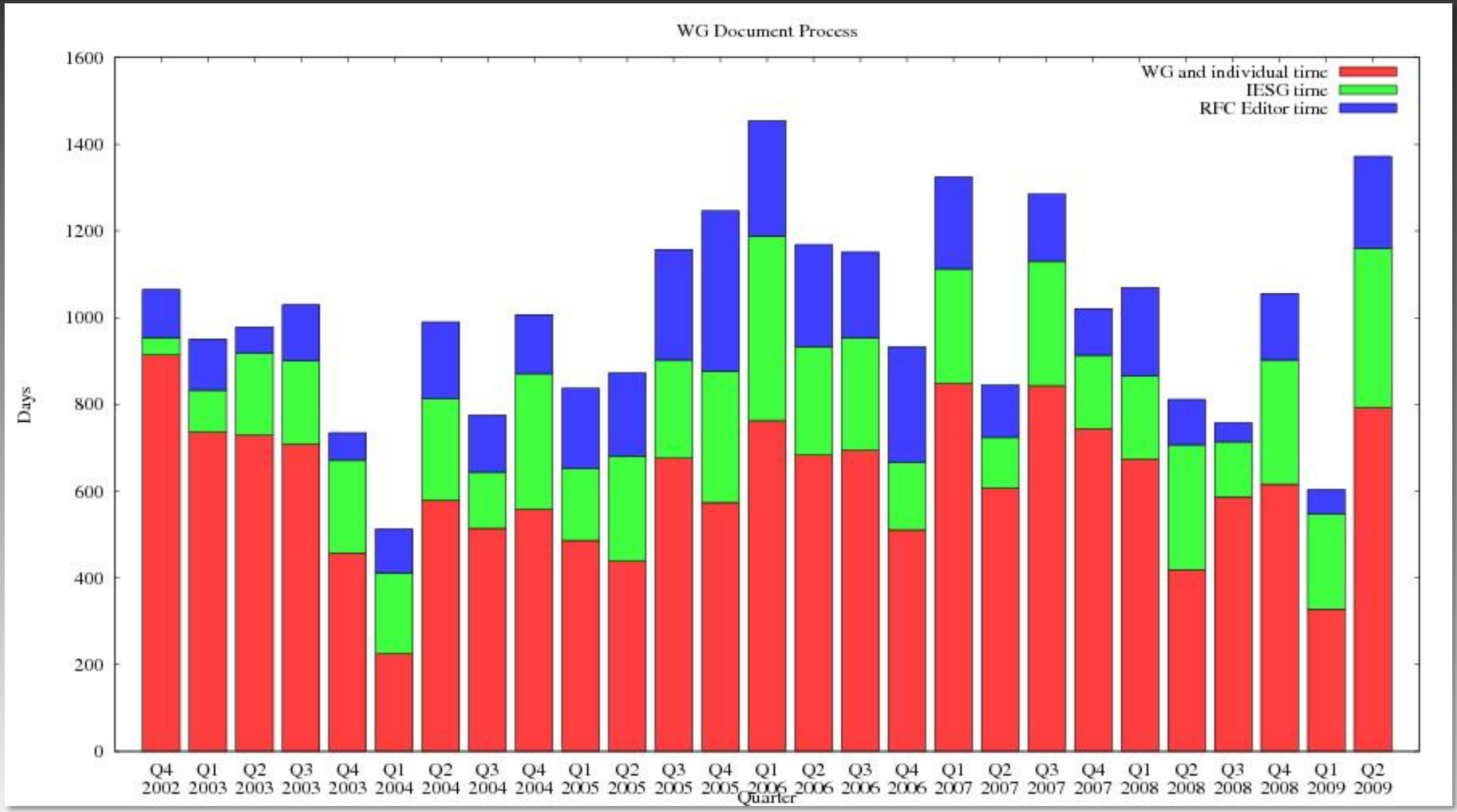
Summarized View of Publication Times



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What if my contribution does not fit an existing WG?

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Initiating New IETF Work – New WG

Make sure no existing WG fits!

If “small”, ask AD for “sponsorship”

Else, need to organize a “Birds of a Feather” (BOF) session at a meeting

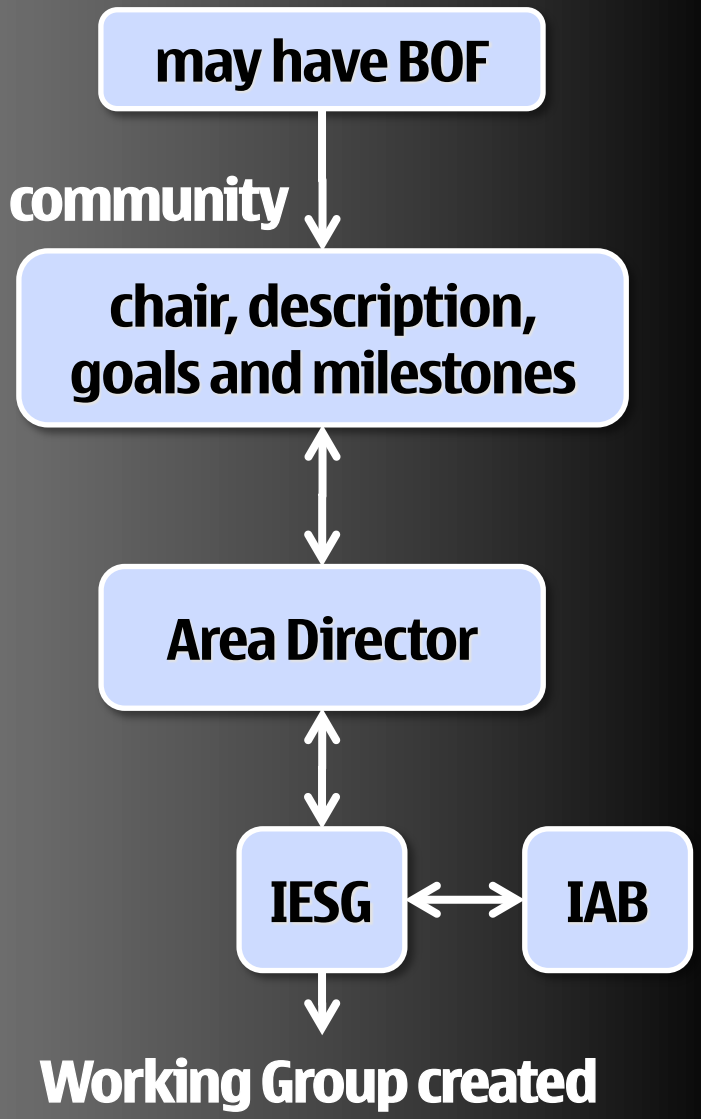
Must form a community of interested people around your proposal (!)

Read RFC5434 & prepare BOF proposal

- Problem statement ID, open mailing list, draft BOF agenda, etc.

Ask an AD for sponsorship

BOF determines if a WG may form



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Example: PCN (Pre-Congestion Notification)

Idea presented in TSVWG	ca. 2005?
“Bar BOF” at IETF-66 in Dallas, TX	Mar 2006
PCN mailing list created	Aug 2006
draft-chan-pcn-problem-statement-00 posted	Sep 2006
First draft charter posted	Sep 2006
BOF requested	Sep 2006
BOF held at IETF-67 in San Diego, CA, USA	Nov 2006
Charter went for External Review	Feb 2007
WG chartered	Mar 2007

Example: LEDBAT and ALTO

IETF “P2P Infrastructure” Workshop in May 2008

Two BOFs at IETF-72 in Dublin in July 2008

LEDBAT (initially called TANA)		ALTO	
First charter draft	Oct 2008	First charter draft	Jul 2008
External Review	Oct 2008	External Review	Oct 2008
WG chartered	Nov 2008	WG chartered	Nov 2008
1st WG mtg. IETF-73	Nov 2008	1st WG mtg IETF-73	Nov 2008

Example: Re-ECN

Idea presented in TSVWG	ca. 2005?
“Bar BOF” at IETF-67 in San Diego	Nov 2006
“Bar BOF” at IETF-68 in Prague	Mar 2007
“Bar BOF” at IETF-75 in Stockholm	Jul 2009
Maybe real BOF at IETF-76 in Hiroshima	Nov 2009

So far, hundreds of emails, dozens of ID revisions, dozens of IETF presentations. No WG yet, and (obviously) no standards yet.

Don’t be discouraged – be encouraged

But be realistic about the time commitment

Carefully pick those few topics you have the energy to push

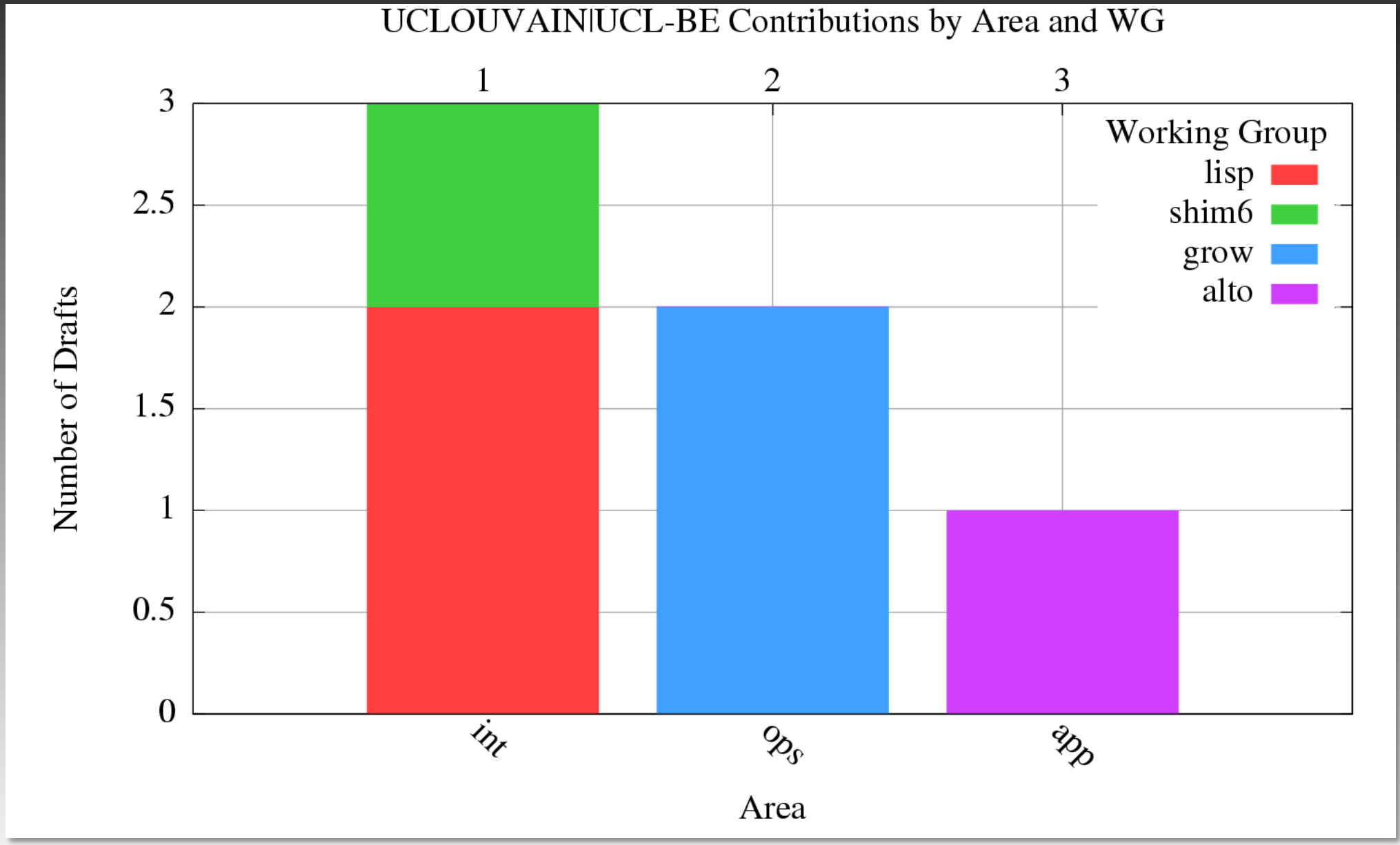
Don’t forget about the IRTF

NOKIA

So what technical areas are universities active in?

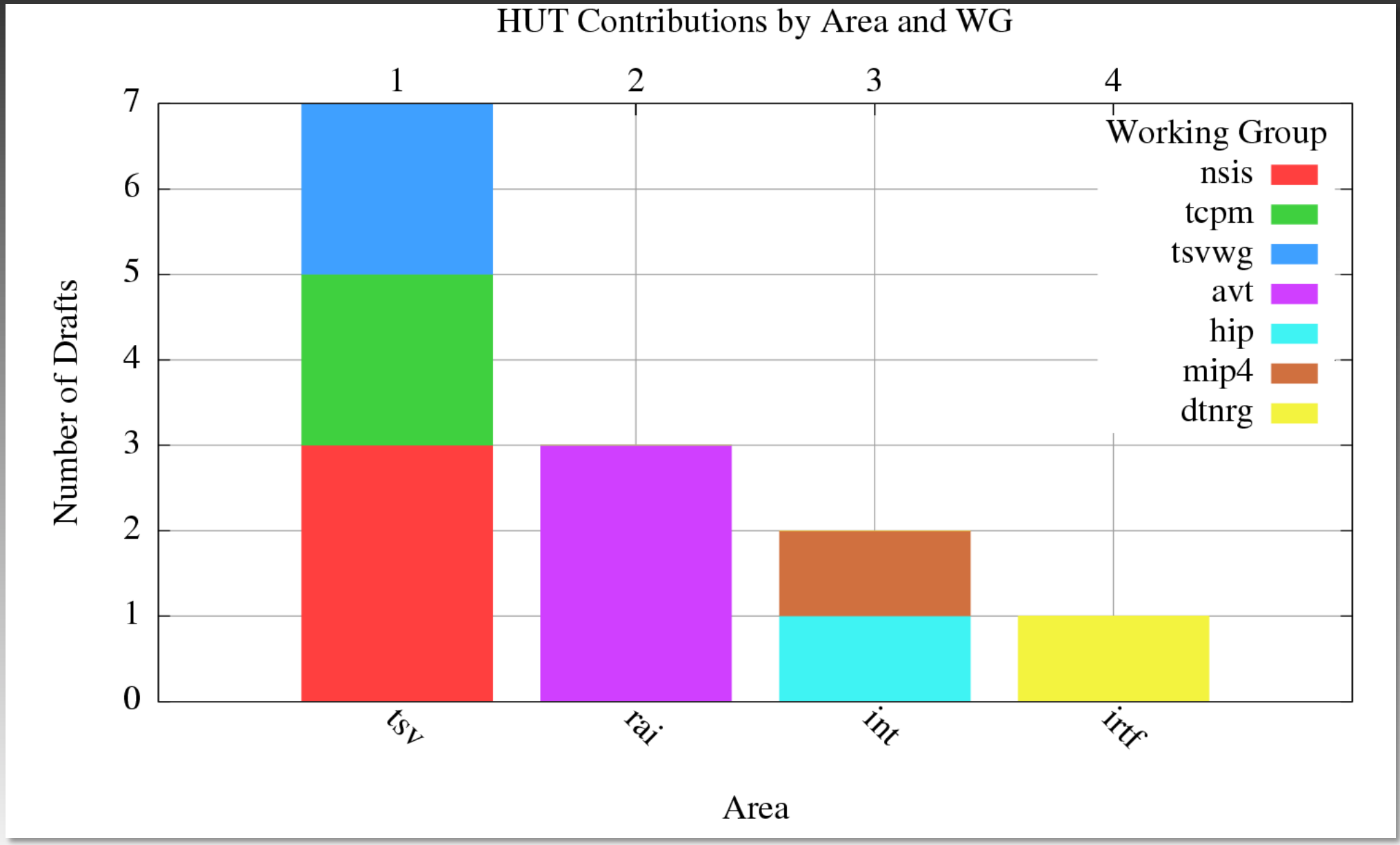
NOKIA

Université Catholique de Louvain



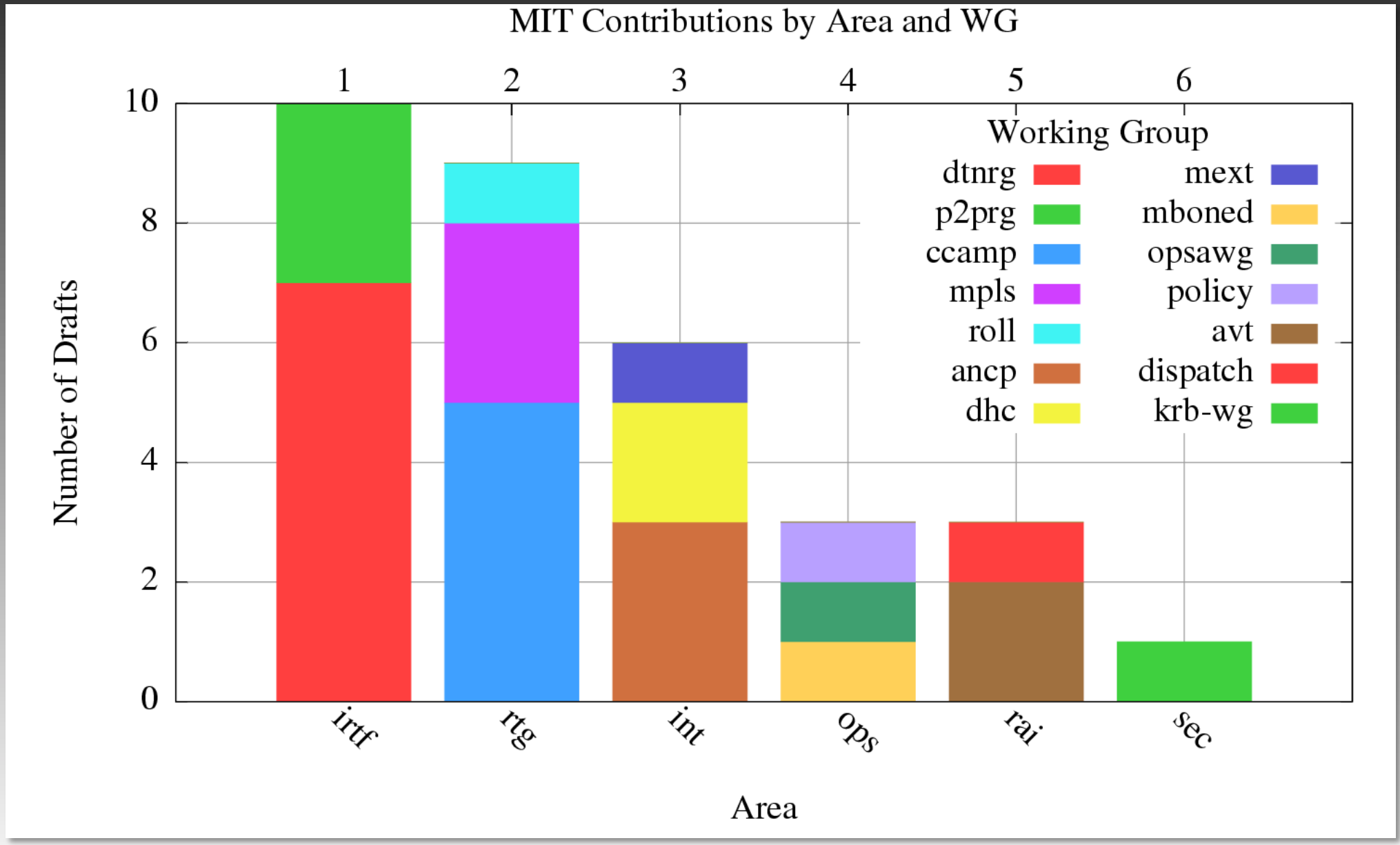
NOKIA

Helsinki University of Technology



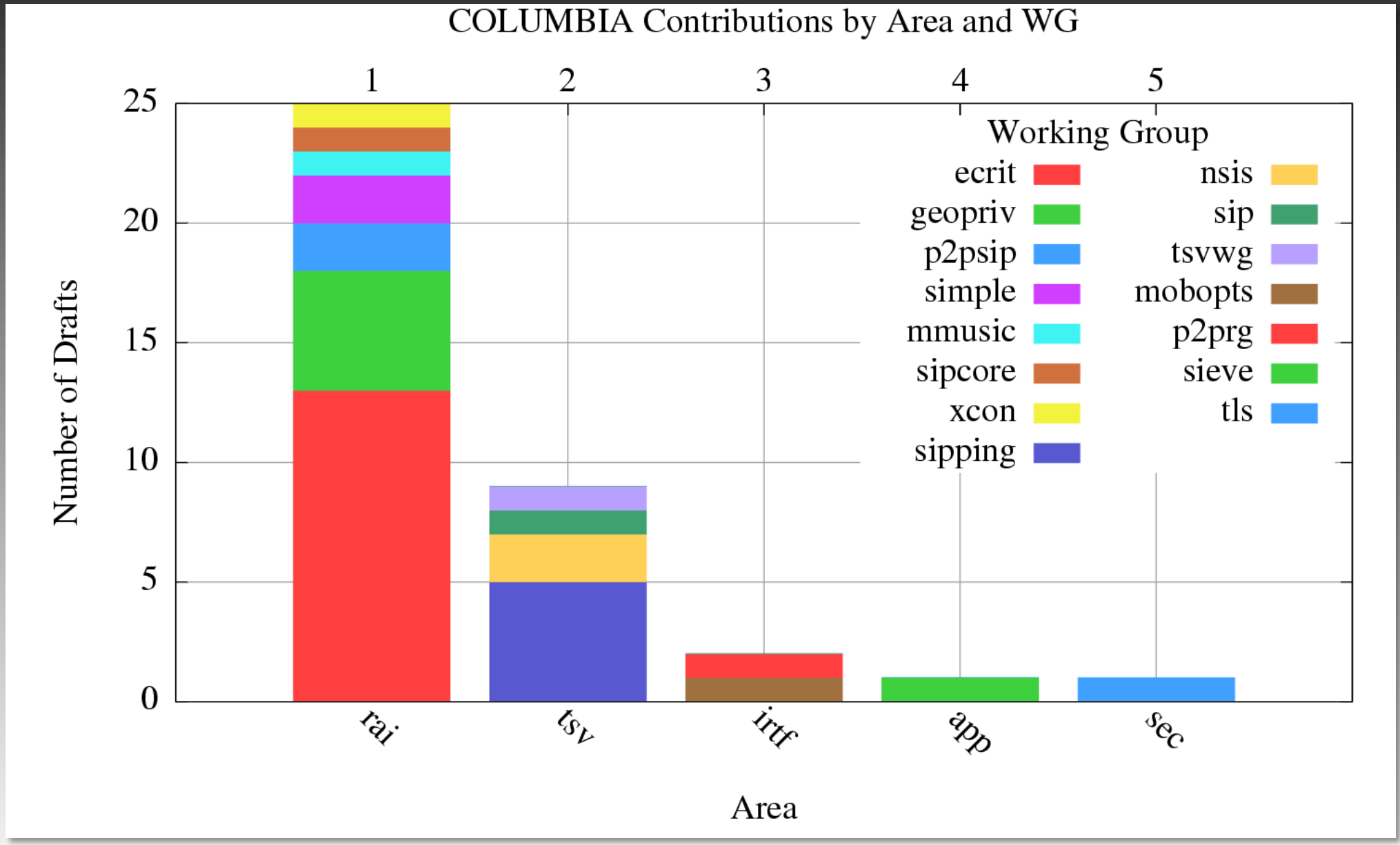
NOKIA

MIT


MIT Contributions by Area and WG
Number of Drafts
Area
1
2
3
4
5
6
0
2
4
6
8
10
irtf
rtg
int
ops
rai
sec
Working Group
dtnrg
p2prg
ccamp
mpls
roll
ancp
dhc
mext
mboned
opsawg
policy
avt
dispatch
krb-wg

NOKIA

Columbia University



NOKIA

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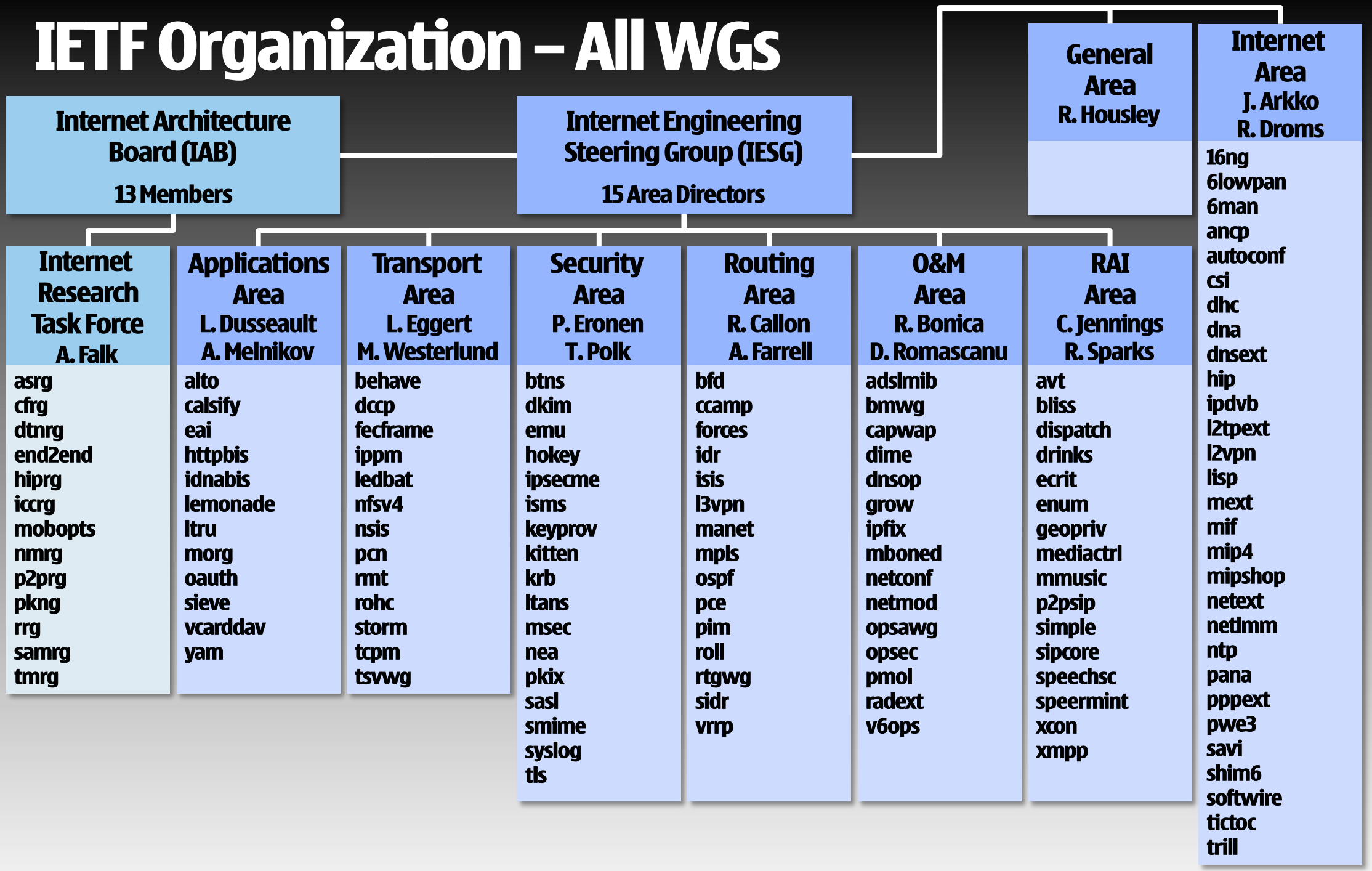
IETF Organization – All WGs



NOKIA