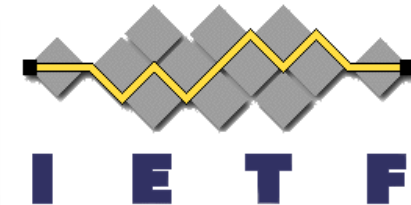# An introduction to the IETF Internet (INT) Area

IETF 103, Bangkok

Pascal Thubert (6tisch/lpwan chair), Suresh Krishnan (Internet Area Director)

What do we want to cover

- Positioning the Internet area in the IETF, IETF in SDOs
- Overview of the areas
- Overview of the Internet area working groups
- Highlights
- Brief summaries of the working groups
- Pointers to some of the important documents relevant to the area
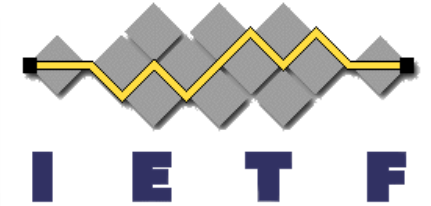- How to find further information?

Standards Developing Organizations (SDOs)

IETF   IEEE   ...   ETSI   ITU-T   ...   ODVA   AVNU   ...
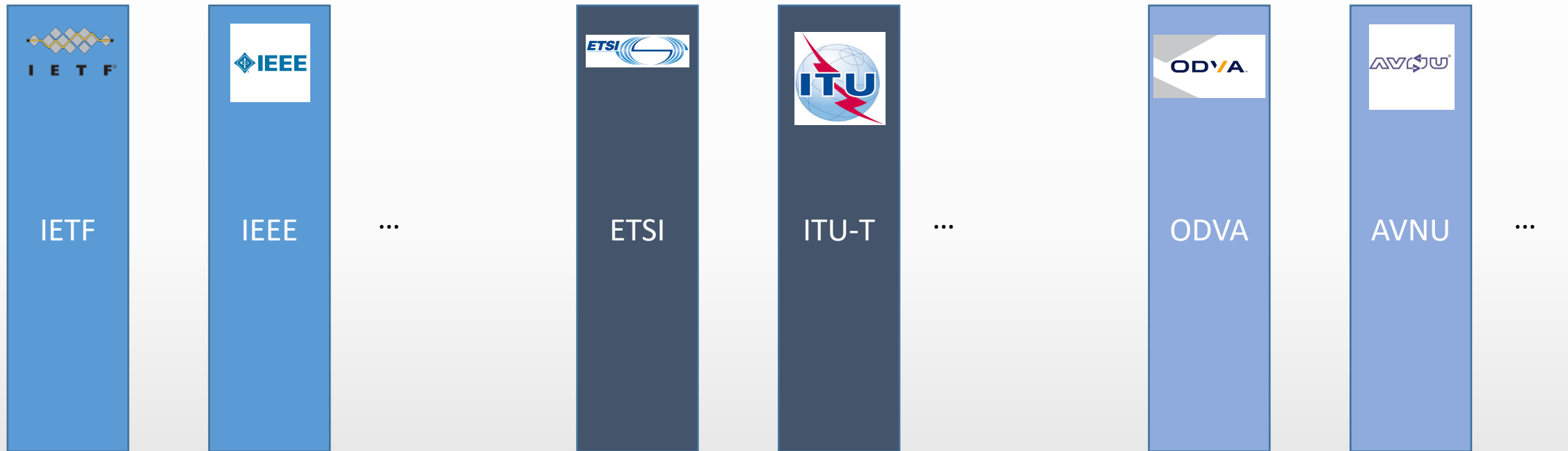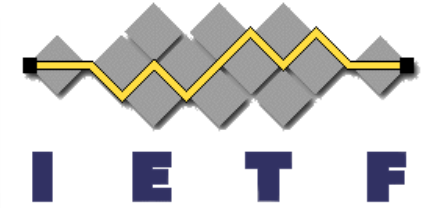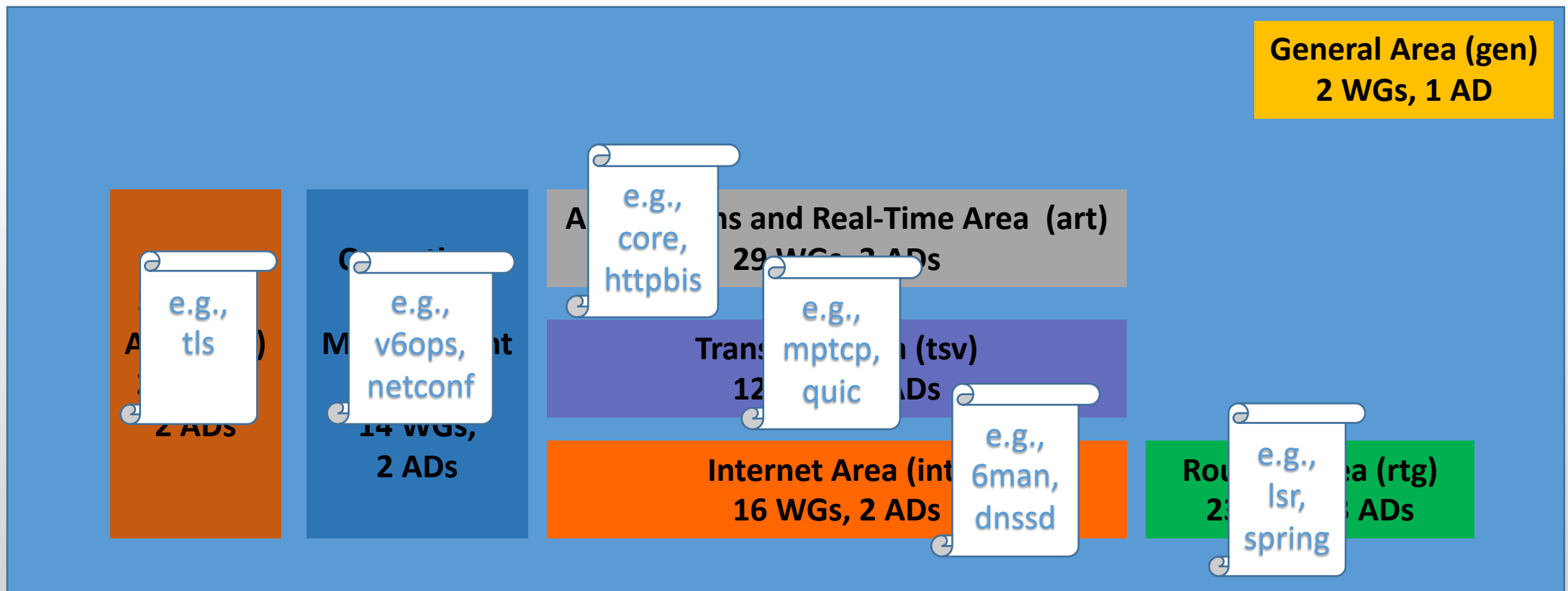
Open / Enterprise Sponsoring   Country / region Oriented   Vertical Market Oriented
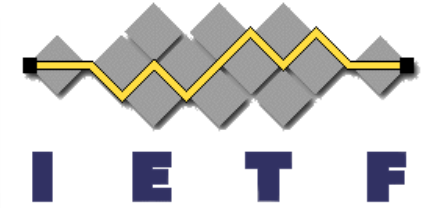
The IETF is divided in Areas

Used to change often, very stable for the last 10+ years

General Area (gen)
2 WGs, 1 AD

e.g., core, httpbis

A...ns and Real-Time Area (art)
29 WGs, 3 ADs

e.g., mptcp, quic

Trans... (tsv)
12... ADs

e.g., tls

A...)
2 ADs

e.g., v6ops, netconf

M... nt
14 WGs, 2 ADs

e.g., 6man, dnssd

Internet Area (int...
16 WGs, 2 ADs

e.g., lsr, spring

Rou... ea (rtg)
2... ADs

The Internet Area:
a Focus on IP layer technologies

- IP core protocols including DNS, IPv6, DHCP, ICMP...
- Mobility and multihoming (Mobile IP, HIP, DMM)
- Simpler to automatic operations (Homenet)
- IPv4/v6 transition, coexistence, and sunsetting IPv4 (6MAN, Softwire)
- Constrained devices (6lo, 6TiSCH, LWIG, IPWave)
- Time- related protocols (TICTOC ,NTP)

# The Internet Area: Working groups summary
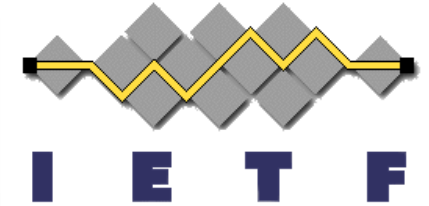
int Area Directors (ADs)   **Suresh Krishnan**   **Terry Manderson**

int area directorate (INT-DIR)

Group	Responsible AD	Name	Chairs
6lo	Suresh	IPv6 over Networks of Resource-constrained Nodes	Samita Chakrabarti , Gabriel Montenegro
6man	Suresh	IPv6 Maintenance	Bob Hinden , Ole Trøan
6tisch	Suresh	IPv6 over the TSCH mode of IEEE 802.15.4e	Pascal Thubert , Thomas Watteyne
dhc	Suresh	Dynamic Host Configuration	Tomek Mrugalski , Bernie Volz
dmm	Suresh	Distributed Mobility Management	Sri Gundavelli , Dapeng Liu
dnssd	Terry	Extensions for Scalable DNS Service Discovery	David Schinazi , Barbara Stark
dprive	Terry	DNS PRIVate Exchange	Brian Haberman , Tim Wicinski
hip	Terry	Host Identity Protocol	Gonzalo Camarillo
homenet	Terry	Home Networking	Stephen Farrell , Barbara Stark
intarea	Suresh	Internet Area Working Group	Wassim Haddad , Juan-Carlos Zúñiga
ipwave	Suresh	IP Wireless Access in Vehicular Environments	Carlos Bernardos , Russ Housley
lpwan	Suresh	IPv6 over Low Power Wide-Area Networks	Alexander Pelov , Pascal Thubert
lwig	Suresh	Light-Weight Implementation Guidance	Zhen Cao , Mohit Sethi
ntp	Suresh	Network Time Protocol	Karen O'Donoghue , Dieter Sibold
softwire	Terry	Softwires	Yong Cui , Ian Farrer
tictoc	Suresh	Timing over IP Connection and Transfer of Clock	Karen O'Donoghue , Yaakov Stein
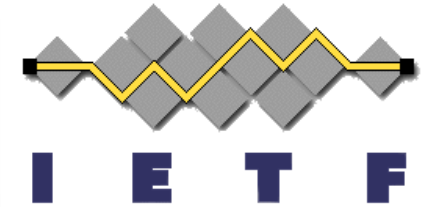
6MAN: Interesting because:

- Defines / controls the Evolution of IPv6
  - And prepare for IPv4 sunset
- Sociological dimension
  - Address Privacy
  - Freedom to form an address
- Political dimension
  - Conservationists care for a stable protocol to encourage deployments
  - Progressists want the protocol to evolve, else it dies (e.g., SR, BBR)
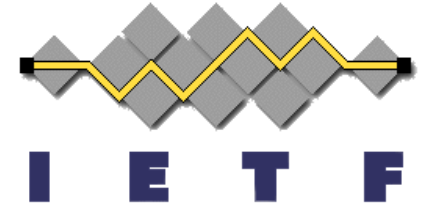- Law and order dimension
  - SAVI

v6Ops: Interesting because:
## (6MAN's counterpart in ops area)
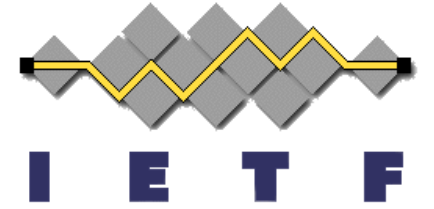
- Operation crowd practicing the technology
- Feeds back on the protocol in the real world
- Produces Best Practices

6lo and LPWAN: Interesting because:

- Low Power Link layer crowds
  - BLE, BACNet, NFC, PowerLine, ZWave, 802.15.4, LoRaWAN, NB IOT, SIGFOX…
- IOT: new Internet use cases
  - Metering and Automation
  - Industrial Internet
- Redefining some classical operation
  - IPv6 ND
- Providing new solutions to
  - Fragmentation for small MTUs
  - Header Compression
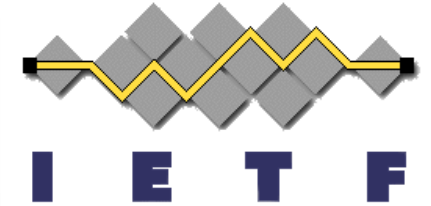
6TiSCH: Interesting because:

- Produces an architecture
  - Selection of IETF components to build a generic system: a "meta RFC"
  - Allows for both deterministic and statistical mux / best effort traffic
- Interaction with other SDOs
  - IEEE for IEEE Std. 802.15.4 MAC evolution
  - ETSI for Interop testing
- Interaction with open source
  - WG tracks open source implementations and supports plugtests
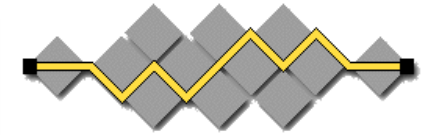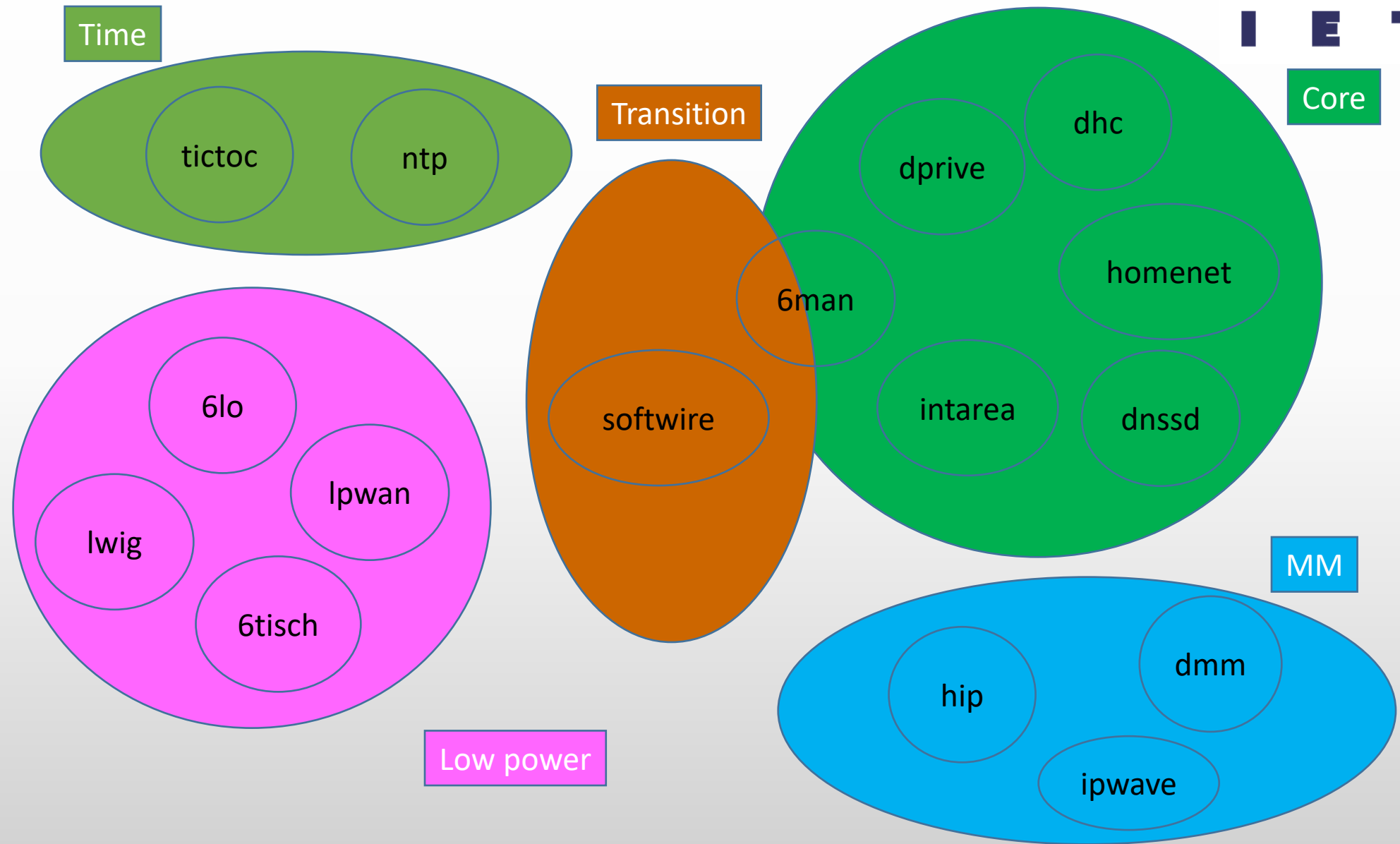 - F-interop
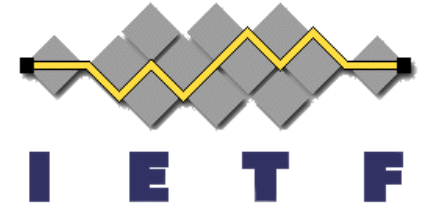
Deeper dive

Based on slides by

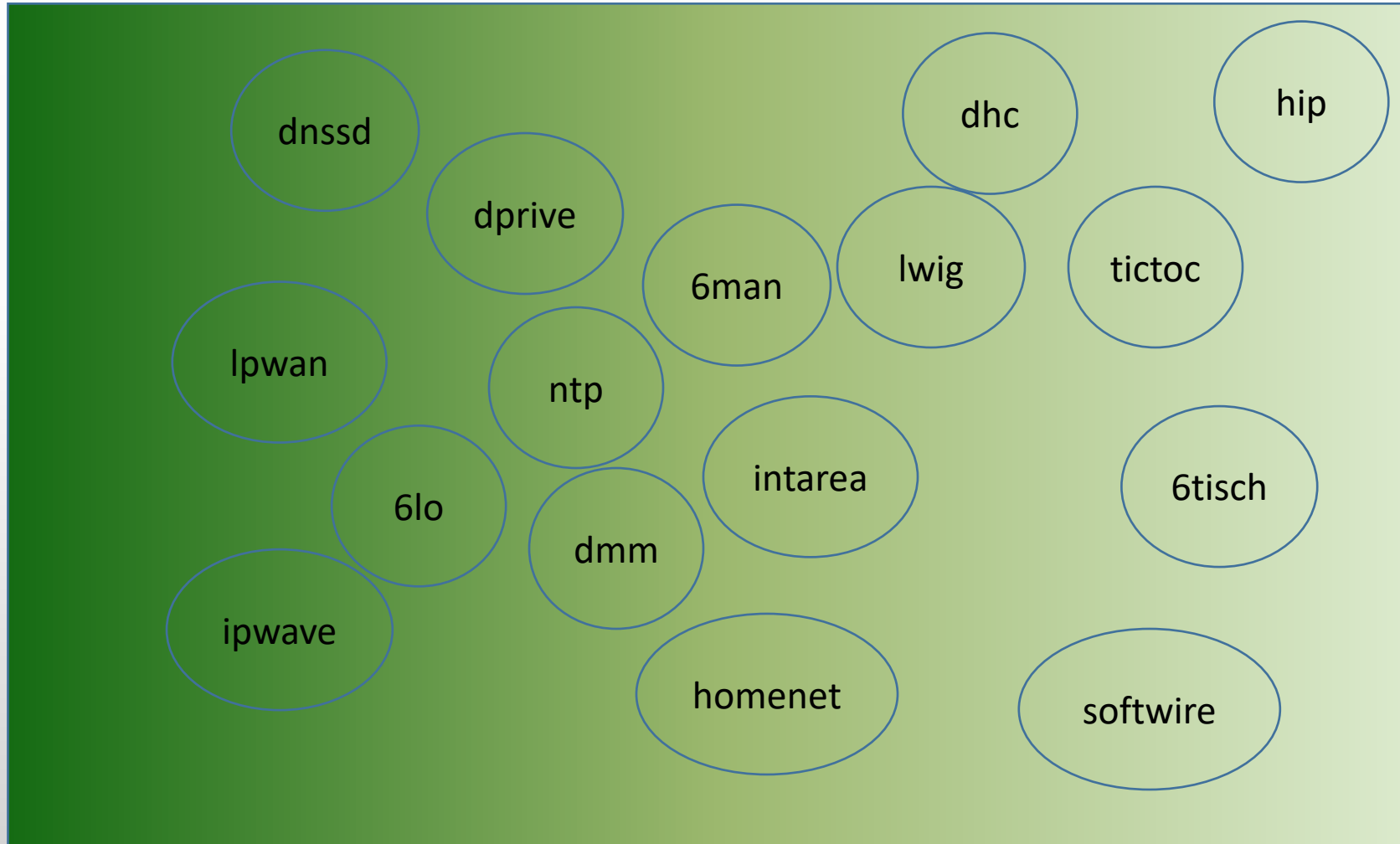*Suresh Krishnan*

WGs by technology area

By phase of work

Starting up — Working steady — Winding down

dnssd, dprive, dhc, hip, lpwan, 6man, lwig, tictoc, ntp, intarea, 6lo, dmm, 6tisch, ipwave, homenet, softwire
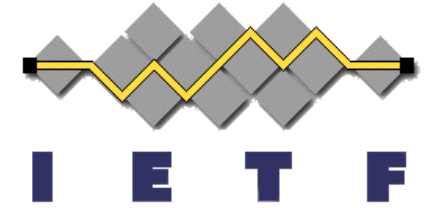
6lo
IPv6 over Networks of Resource-constrained Nodes

- 6lo focuses on the work that facilitates IPv6 connectivity over constrained node networks

- Main areas of work
  - IPv6-over-<link> adaptation layer specifications for link layer technologies used in constrained node networks
  - Information and data models (e.g., MIB modules, YANG models) for these adaptation layers
  - Common mechanisms such as low-complexity header compression, that are applicable to more than one adaptation layer specification
  - Maintenance and informational documents required for the existing IETF specifications in this space (e.g. work from the erstwhile 6lowpan wg)
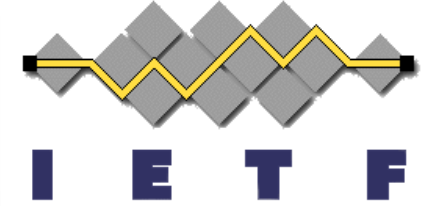
6man
IPv6 Maintenance

- The 6man working group is responsible for the maintenance, upkeep, and advancement of the core IPv6 protocol specifications

- It is the design authority for extensions and modifications to the IPv6 protocol

- Reviews and signs off on documents produced in other working groups that extend or modify the IPv6 protocol

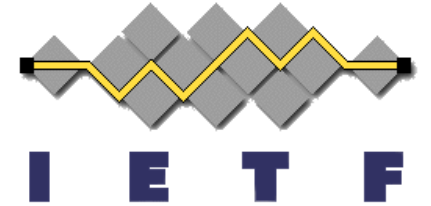# 6tisch

IPv6 over the TSCH mode of IEEE 802.15.4e
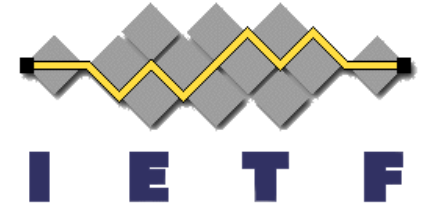
- The IEEE802.15.4e Time-slotted Channel Hopping (TSCH) is a recent amendment to the IEEE802.15.4 MAC

- The 6tisch working group works on defining IPv6 over TSCH in order to enable the further adoption of IPv6 in industrial standards

- Currently limited to working on distributed routing over a static schedule
 - May work on a dynamic schedule in the future

dhc
Dynamic Host Configuration

- The dhc working group is one of the oldest working groups in the IETF (Originally chartered in 1991 ☺)
- It is tasked with
  - Developing extensions to the DHCPv6 infrastructure as required to meet new applications and deployments
  - Documenting operational considerations for the wider community
  - Maintenance and upkeep of the core DHCP specifications
  - Reviewing DHCP options defined in other WGs in association with the Internet Area Directorate
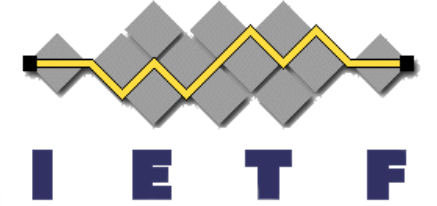
dmm

Distributed Mobility Management

MM

- The dmm working group specifies Distributed Mobility Management solutions for IP networks so that traffic between mobile and correspondent nodes can take an optimal route

- It is also chartered to work on maintenance and bug fixes of the specifications in the Mobile IPv6 protocol family
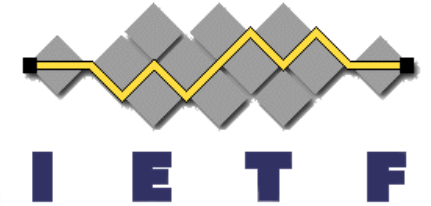
dnssd

Extensions for Scalable DNS Service Discovery

- The DNS-SD [RFC 6763] and mDNS [RFC 6762] protocol suite (aka Apple Bonjour) is widely used for DNS-based service discovery and host name resolution on a single link

- There are several use cases such as multi-link residential, campus, and enterprise networks where it could be useful to used to discover services on remote links
  - Unfortunately, the mDNS protocol is constrained to link-local multicast scope by design, and therefore cannot be used to discover services on remote links

- The focus of the dnssd working group is to develop a solution for extended, scalable DNS service discovery
  - Document requirements for such a solution under selected scenarios
  - Develop an improved, scalable solution for service discovery that can operate in multi-link networks
  - To document challenges and problems encountered in the coexistence of zero configuration and global DNS name services in such multi-link networks
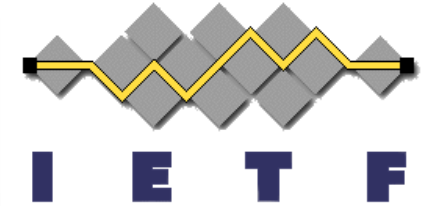
dprive
DNS PRIVate Exchange

- The dprive working group develops mechanisms to provide confidentiality to DNS transactions, to address concerns surrounding pervasive monitoring

- Primary focus of this Working Group is to develop mechanisms that provide confidentiality between DNS Clients and Iterative Resolvers
  - At a later time the wg may also consider mechanisms that provide confidentiality between Iterative Resolvers and Authoritative Servers

- Attempts to maintain backward compatibility with legacy DNS implementations as well as minimize application-level changes

hip
Host Identity Protocol

MM
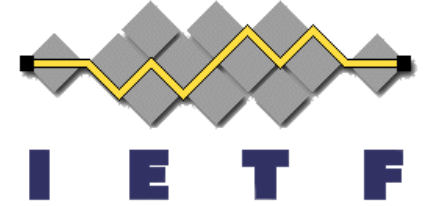
- The Host Identity Protocol (HIP) provides a method of separating the end-point identifier and locator roles of IP addresses

- The HIP architecture and protocol mechanisms had been published as Experimental RFCs
  - effects of the protocol on applications and on the Internet as a whole were not known

homenet
Home Networking
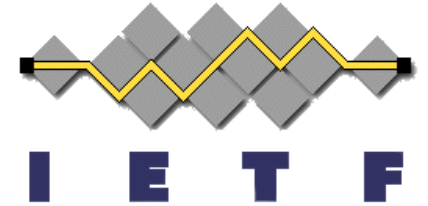
- This working group focuses on the evolving networking technology within and among relatively small residential networks
  - Designed to work on residential networks involving multiple routers and subnets
  - Mainly focused on IPv6 based operation
- Focused on meeting the following requirements
  - Prefix configuration for routers
  - Managing routing
  - Name resolution
  - Service discovery
  - Network security
- Architectural principles have been specified
  - Protocol work is ongoing
  - Selection of a routing protocol for use in homenet is also ongoing
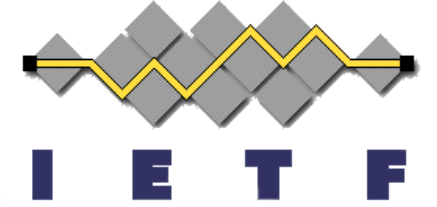
ipwave
IP Wireless Access in Vehicular Environments

- The ipwave working group works on V2V and V2I use-cases where IP is well-suited as a networking technology and will develop an IPv6 based solution to establish direct and secure connectivity between a vehicle and other vehicles or stationary systems.

- This group's primary deliverable (and the only Standards track item) will be a document that will specify the mechanisms for transmission of IPv6 datagrams over IEEE 802.11-OCB mode.

lpwan
IPv6 over Low Power Wide-Area Network
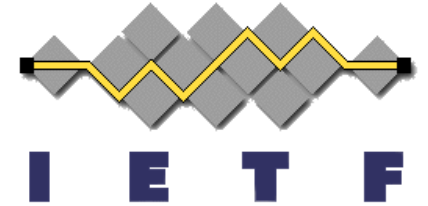
- lpwan focuses on enabling IPv6 connectivity over the following selection of Low-Power Wide-Area technologies: SIGFOX, LoRa, WI-SUN and NB-IOT.

- Main areas of work
  - Produce an Informational document describing and relating some selected LPWA technologies (done)
  - Produce a Standards Track document to enable the compression and fragmentation of a CoAP/UDP/IPv6 packet over LPWA networks. This is being achieved through stateful mechanisms, specifically designed for star topology and severely constrained links.
  - Next: Data Model for the network side, ICMP, IPv4, …

intarea
Internet Area Working Group

- Serves primarily as a forum for discussing far-ranging topics that affect the entire area
  - Share information about ongoing activities in the area
  - Create a shared understanding of the challenges and goals for the area
  - Point of co-ordination
- Also works on development and publication of one-off RFCs that do not justify the formation of a new working group
  - Either not in scope of an existing working group
  - or relevant to more than one INT area working group

Low power

lwig
Light-Weight Implementation Guidance
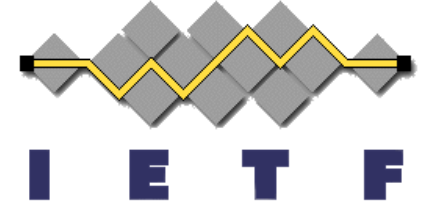
- The LWIG working group focuses on collecting and documenting experiences from implementers of IP stacks in constrained devices
  - implementation techniques for reducing complexity, memory footprint, or power usage

ntp
Network Time Protocol
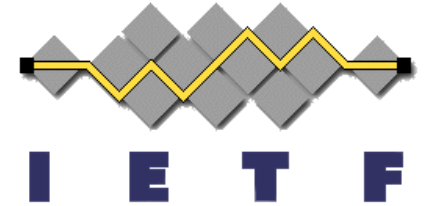
- The Network Time Protocol synchronizes clocks across a network
  - It is one of the oldest and most widely deployed protocols on the Internet
- The NTP working group maintains the Network Time Protocol specifications
- Current efforts include:
  - maintenance of NTPv4 specifications (e.g. extension header clarifications)
  - development of Network Time Security (replacement for Autokey)
  - documentation of Best Current Practices
  - development of a YANG module
  - collection of requirements for next steps for NTP

softwire
Softwires
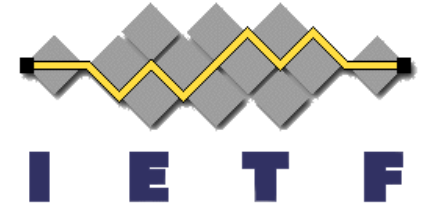
- Focuses on the specification of IPv4-IPv6 transition and co-existence mechanisms that are based on encapsulation (i.e. tunneling)
  - Discovery, control and encapsulation methods for connecting IPv4 networks across IPv6 networks and vice versa
  - Management mechanisms for these methods (e.g. provisioning, MIBs, RADIUS etc.)
  - Implementation considerations for handling selection and use of one of these transition/co-existence solutions
- Work has been mostly completed and wg will be closed or rechartered soon

tictoc
Timing over IP Connection and Transfer of Clock

- The Timing over IP Connection and Transfer of Clock (tictoc) working group was chartered to look at next generation time synchronization protocols
  - including the interoperation of IEEE 1588 Precise Time Protocol with IETF Protocols.
- Current efforts include:
  - Security requirements for time synchronization protocols
  - IEEE 1588 Enterprise profile
  - Experimental draft on 1588 over MPLS networks
  - Experimental multipath synchronization technique
  - IEEE 1588v2 management (MIB and YANG modules)

Internet Area Directorate
INT Dir
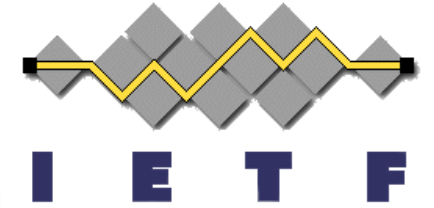
- The Internet Area Directorate is an advisory group of experts selected by the Internet Area Directors.

- Reviews documents as and when requested by the INT Area Directors.

- Mentor newer IETF participants
  - Identify participants who have the potential to be useful, contributing members to the directorate and
  - Help them with exposure/tutoring from more experienced IETF participants
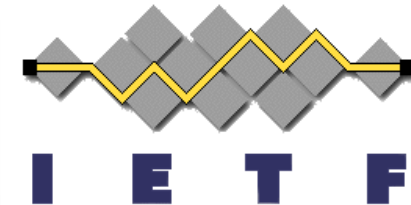
Closely aligned areas

- OPS
  - IPv6 adoption/transition/co-existence
  - MIB & Yang model development
  - AAA (RADIUS and DIAMETER) support
- RTG
  - Interactions between IP and Routing protocols
  - Home networking
- SEC
  - Security Considerations, DNSSEC, Network Access Control
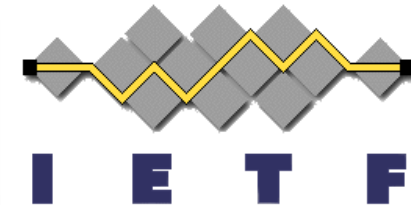
Pointers to background reading

- IPv4 – RFC 791

- IPv6 – RFC 4443, RFC 4861, RFC 4862, RFC 8200, RFC 8201

- DNS – RFC 1035

- DHCPv4 – RFC 2131

- DHCPv6 – RFC 3315*-> (RFC8415)

- MIPv4 – RFC 5944

- MIPv6 – RFC 6275

- NTP - RFC 5905

CAUTION
Subject to change

* In the process of being updated
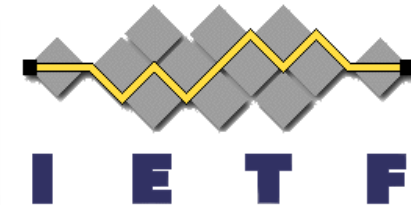
For further information

- Current list of wgs in the Internet Area
  http://datatracker.ietf.org/wg/#int

- Information about a specific working group
  - Mailing list information and archives
  - Charter, milestones and deliverables
  - Associated documents…

  http://datatracker.ietf.org/wg/<wg_name>/

Example working group information

WG Drafts

RFCs

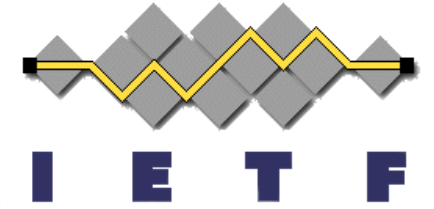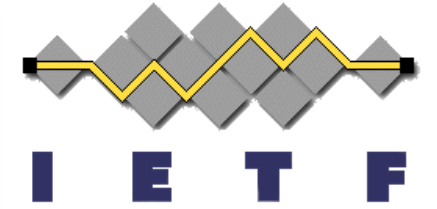# Example working group information

Questions?

Acknowledgments

- Thanks to Suresh Krishnan, and by inheritance, Mirjam Kuehne, Karen O' Donoghue, Alice Russo, Brian Carpenter, Scott Bradner and all the wonderful folks on the EDU team for their contributions and feedback

Links

- You can find these slides at
  - http://wiki.tools.ietf.org/group/edu/wiki/IETF103
  - Please spend a minute to take a survey about this presentation
  - https://www.surveymonkey.com/r/intoverview
  - The EDU team (and I) would love to hear your views