

The IETF is organized into 10 Areas with a number of Working Groups per Area. In order for the information provided to be the most up to date, links are provided to the IETF website for the relevant working groups. The specific RFCs and Internet drafts for each highlighted area are not included in the table below, but a link is provided to the IETF website where the entire list and current status can be found.

Activity domain	Stage (topic)	Area	Entity	Title of deliverable	Scope of deliverable	Current status
Cloud SDN	Area	Application	IETF	Application Area	The Applications Area has historically focused on three clusters of protocols. The first cluster contains application protocols that have been ubiquitous for some time but which continue to develop (e.g., email, HTTP, FTP). The second cluster contains protocols which are used for Internet infrastructure (e.g., IDNA and EPP). The third cluster contains "building block" protocols which are designed for re-use in a variety of more specific applications (e.g., LDAP, MIME types, URI schemes, URNs, OAuth, language tags). Current working groups include topics such as: email, web foundations and security, calendaring, internationalization, virtual worlds, personal address books, simple resource manipulation protocol for devices in constrained networks, some helper technologies for network storage and peer-to-peer applications.	Relevant working groups httpbis Hypertext Transfer Protocol Bis scim System for Cross-domain Identity Management weirds Web Extensible Internet Registration Data Service

					[IETF Areas]	
Cloud SDN	Working Group	Application	IETF	httpbis Hypertext Transfer Protocol Bis	This Working Group is charged with maintaining and developing the "core" specifications for HTTP https://datatracker.ietf.org/wg/httpbis/charter/	Working Group Documents https://datatracker.ietf.org/wg/httpbis/
Cloud SDN	Working Group	Application	IETF	scim System for Cross-domain Identity Management	The System for Cross-domain Identity Management (SCIM) working group will standardize methods for creating, reading, searching, modifying, and deleting user identities and identity-related objects across administrative domains, with the goal of simplifying common tasks related to user identity management in services and applications. http://datatracker.ietf.org/wg/scim/charter/	Working Group Documents http://datatracker.ietf.org/wg/scim/
Cloud SDN	Working Group	Application	IETF	weirds Web Extensible Internet Registration Data Service	Internet registries for both number resources and names have historically maintained a lookup service to permit public access to some portion of the registry database. Most registries offer the service via WHOIS (RFC 3912), with additional services being offered via world wide web pages, bulk downloads, and other services, such as RPSL (RFC 2622). http://datatracker.ietf.org/wg/weirds/chart	Working Group Documents http://datatracker.ietf.org/wg/weirds/

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Cloud SDN	Area	Internet	IETF	Internet Area	<p>The primary technical topics covered by the Internet Area include IP layer (both IPv4 and IPv6), implications of IPv4 address depletion, co-existence between the IP versions, DNS, DHCP, host and router configuration, mobility, multihoming, identifier-locator separation, VPNs and pseudowires along with related MPLS issues, and various link layer technologies. The Internet Area is also responsible for specifying how IP will run over new link layer protocols.</p> <p>[IETF Areas]</p>	<p>Relevant Working Groups</p> <p>lisp Locator/ID Separation Protocol</p>
Cloud SDN	Working Group	Application	IETF	lisp Locator/ID Separation Protocol	<p>The basic idea behind the separation is that the Internet architecture combines two functions, routing locators, (where you are attached to the network) and identifiers (who you are) in one number space: The IP address. Proponents of the separation architecture postulate that splitting these functions apart will yield several advantages, including improved scalability for the routing system. The separation aims to decouple locators and identifiers, thus allowing for efficient aggregation of the routing locator space and providing persistent identifiers in the identifier space.</p>	<p>Working Group Documents</p> <p>https://datatracker.ietf.org/wg/lisp/</p>

					https://datatracker.ietf.org/wg/lisp/charter/	
Cloud SDN	Area	Management	IETF	Operations and Management Area	<p>The primary technical areas covered by the Operations & Management (OPS) Area include: Network Management, AAA, and various operational issues facing the Internet such as DNS operations, IPv6 operations, operational security and Routing operations.</p> <p>[IETF Areas]</p>	<p>Relevant Working Groups</p> <p>dnsop Domain Name System Operations</p> <p>lmap Large-Scale Measurement of Broadband Performance</p> <p>netconf Network Configuration</p> <p>netmod NETCONF Data Modeling Language</p>
Cloud SDN	Working Group	Management	IETF	dnsop Domain Name System Operations	<p>The DNS Operations Working Group will develop guidelines for the operation of DNS software servers and the administration of DNS zone files. These guidelines will provide technical information relating to the implementation of the DNS protocol by the operators and administrators of DNS zones</p> <p>http://datatracker.ietf.org/wg/dnsop/charter</p>	<p>Working Group Documents</p> <p>http://datatracker.ietf.org/wg/dnsop/</p>

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Cloud SDN	Working Group	Management	IETF	lmap Large-Scale Measurement of Broadband Performance	<p>The Large-Scale Measurement of Broadband Performance (LMAP) working group standardizes the LMAP measurement system for performance measurements of broadband access devices such as home and enterprise edge routers, personal computers, mobile devices, set top box, whether wired or wireless.</p> <p>http://datatracker.ietf.org/wg/lmap/</p>	<p>Working Group Documents</p> <p>http://datatracker.ietf.org/wg/lmap/</p>
Cloud SDN	Working Group	Management	IETF	netconf Network Configuration	<p>Configuration of networks of devices has become a critical requirement for operators in today's highly interconnected networks. Large and small operators alike have developed their own mechanisms or have used vendor specific mechanisms to transfer configuration data to and from a device and to examine device state information which may impact the configuration. Each of these mechanisms may be different in various aspects, such as session establishment, user authentication, configuration data exchange, and error responses.</p> <p>http://datatracker.ietf.org/wg/netconf/char</p>	<p>Working Group Documents</p> <p>http://datatracker.ietf.org/wg/netconf/</p>

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Cloud SDN	Working Group	Management	IETF	netmod NETCONF Data Modeling Language	<p>The NETCONF Working Group has completed a base protocol to be used for configuration management. However, the NETCONF protocol does not include a modeling language or accompanying rules that can be used to model the management information that is to be configured using NETCONF. The NETMOD working group has defined the data modeling language YANG but no IETF models exist yet. The purpose of the NETMOD working group is to support the ongoing deployment of YANG by developing a set of core YANG data models and other activities that will allow network operators to use YANG for configuration and management of network elements.</p> <p>http://datatracker.ietf.org/wg/netmod/charter/</p>	<p>Working Group Documents</p> <p>http://datatracker.ietf.org/wg/netmod/</p>
Cloud SDN	Area	Internet	IETF	Real-time Applications and Infrastructure Area	<p>The Real-Time Applications and Infrastructure (RAI) Area develops protocols and architectures for delay-sensitive interpersonal communications. Work in the RAI Area serves an industry whose applications and services include voice and video over IP, instant messaging, and</p>	<p>Relevant Working Groups</p> <p>geopriv Geographic Location/Privacy</p>

					<p>presence. These applications and services are "real-time" in the sense described in RFC 3550.</p> <p>[IETF Areas]</p>	
Cloud SDN	Working Group	Real-Time Applications	IETF	geopriv Geographic Location/Privacy	<p>The IETF has recognized that many applications are emerging that require geographic and civic location information about resources and entities, and that the representation and transmission of that information has significant privacy and security implications. We have created a suite of protocols that allow such applications to represent and transmit such location objects and to allow users to express policies on how these representations are exposed and used. The IETF has also begun working on creating applications that use these capabilities, for emergency services, general real-time communication, and other usages.</p> <p>https://datatracker.ietf.org/wg/geopriv/charter/</p>	<p>Working Group Documents</p> <p>https://datatracker.ietf.org/wg/geopriv/</p>
Cloud	Area	Routing	IETF	Routing Area	The Routing Area is responsible for ensuring continuous operation of the Internet routing	Relevant Working

SDN				<p>system by maintaining the scalability and stability characteristics of the existing routing protocols, as well as developing new protocols, extensions, and bug fixes in a timely manner. Forwarding methods (such as destination-based unicast and multicast forwarding, MPLS, and pseudowire) as well as associated routing and signalling protocols (such as OSPF, IS-IS, BGP, RSVP-TE, LDP, PIM, L1-, L2-, and L3-VPNs) are within the scope of the Routing Area. Traffic engineering routing and signaling protocols are in scope, as is the architecture and protocols for the Path Computation Element that helps to select end-to-end paths for traffic-engineered routing. The Routing Area also works on Generalized MPLS used in the control plane of optical networks as well as security aspects of the routing system. The Routing Area has recently developed a routing protocol (RPL) for use in low-powered and lossy networks.</p> <p>[IETF Areas]</p>	<p>Groups</p> <p>forces</p> <p>Forwarding and Control Element Separation</p> <p>i2rs</p> <p>Interface to the Routing System</p> <p>idr</p> <p>Inter-Domain Routing</p> <p>karp</p> <p>Keying and Authentication for Routing Protocols</p> <p>l2vpn</p> <p>Layer 2 Virtual Private Networks</p> <p>l3vpn</p> <p>Layer 3 Virtual Private Networks</p> <p>nvo3</p> <p>Network Virtualization Overlays</p> <p>pce</p>
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						Path Computation Element sfc Service Function Chaining sidr Secure Inter-Domain Routing spring Source Packet Routing in Networking
Cloud SDN	Working Group	Routing	IETF	forces Forwarding and Control Element Separation	The ForCES working group has created a framework, requirements, a solution protocol, a logical function block library, and other associated documents in support of Forwarding and Control Element Separation. http://datatracker.ietf.org/wg/forces/charter/	Working Group Documents http://datatracker.ietf.org/wg/forces/
Cloud SDN	Working Group	Routing	IETF	i2rs Interface to the Routing System	I2RS facilitates real-time or event driven interaction with the routing system through a collection of protocol-based control or management interfaces. These allow information, policies, and operational	Working Group Documents http://datatracker.ietf.org/wg/i2rs/

					<p>parameters to be injected into and retrieved (as read or by notification) from the routing system while retaining data consistency and coherency across the routers and routing infrastructure, and among multiple interactions with the routing system. The I2RS interfaces will co-exist with existing configuration and management systems and interfaces.</p> <p>http://datatracker.ietf.org/wg/i2rs/charter/</p>	
Cloud SDN	Working Group	Routing	IETF	idr Inter-Domain Routing	<p>The Inter-Domain Routing Working Group is chartered to standardize, develop, and support the Border Gateway Protocol Version 4 (BGP-4) [RFC 4271] capable of supporting policy based routing for TCP/IP internets.</p> <p>http://datatracker.ietf.org/wg/idr/charter/</p>	<p>Working Group Documents</p> <p>http://datatracker.ietf.org/wg/idr/</p>
Cloud SDN	Working Group	Routing	IETF	karp Keying and Authentication for Routing Protocols	<p>The KARP working group is tasked to work with the routing protocol working groups in order to improve the communication security of the packets on the wire used by the routing protocols. This working group is concerned with message authentication,</p>	<p>Working Group Documents</p> <p>http://datatracker.ietf.org/wg/karp/</p>

					<p>packet integrity, and denial of service (DoS) protection. At present, this charter explicitly excludes confidentiality and non-repudiation concerns.</p> <p>http://datatracker.ietf.org/wg/karp/charter/</p>	
Cloud SDN	Working Group	Routing	IETF	I2vpn Layer 2 Virtual Private Networks	<p>The L2VPN working group is responsible for defining and specifying a limited number of solutions for supporting provider-provisioned Layer-2 Virtual Private Networks (L2VPNs). It will also address requirements driven by cloud computing services and data centers as they apply to Layer-2 VPN services.</p> <p>http://datatracker.ietf.org/wg/l2vpn/charter/</p>	<p>Working Group Documents</p> <p>http://datatracker.ietf.org/wg/l2vpn/</p>
Cloud SDN	Working Group	Routing	IETF	I3vpn Layer 3 Virtual Private Networks	<p>This working group is responsible for defining, specifying and extending BGP/MPLS IP VPNs solutions (based on RFC4364 and RFC4659) for supporting provider-provisioned Layer-3 (routed) Virtual Private Networks (L3VPNs).</p> <p>http://datatracker.ietf.org/wg/l3vpn/charter/</p>	<p>Working Group Documents</p> <p>http://datatracker.ietf.org/wg/l3vpn/</p>

Cloud SDN	Working Group	Routing	IETF	nvo3 Network Virtualization Overlays	Support for multi-tenancy has become a core requirement of data centers (DCs), especially in the context of data centers supporting virtualized hosts known as virtual machines (VMs). http://datatracker.ietf.org/wg/nvo3/charter/	Working Group Documents http://datatracker.ietf.org/wg/nvo3/
Cloud SDN	Working Group	Routing	IETF	pce Path Computation Element	The PCE Working Group is chartered to specify the required protocols so as to enable a Path Computation Element (PCE)-based architecture for the computation of paths for MPLS and GMPLS Point to Point and Point to Multi-point Traffic Engineered LSPs. http://datatracker.ietf.org/wg/pce/charter/	Working Group Documents http://datatracker.ietf.org/wg/pce/
Cloud SDN	Working Group	Routing	IETF	sfc Service Function Chaining	Network operators frequently utilize service functions such as packet filtering at firewalls, load-balancing and transactional proxies (for example spam filters) in the delivery of services to end users. Delivery of these types of services is undergoing significant change with the introduction of virtualization, network overlays, and orchestration. http://datatracker.ietf.org/wg/sfc/charter/	Working Group Documents http://datatracker.ietf.org/wg/sfc/

Cloud SDN	Working Group	Routing	IETF	sidr Secure Inter-Domain Routing	The purpose of the SIDR working group is to reduce vulnerabilities in the inter-domain routing system. http://datatracker.ietf.org/wg/sidr/charter/	Working Group Documents http://datatracker.ietf.org/wg/sidr/
Cloud SDN	Working Group	Routing	IETF	spring Source Packet Routing in Networking	Source-based routing mechanisms have previously been specified for network protocols, but have not seen widespread adoption other than in MPLS traffic engineering. These network functions may require greater flexibility and per packet source imposed routing than can be achieved through the use of the previously defined methods. In the context of this charter, 'source' means 'the point at which the explicit route is imposed'. http://datatracker.ietf.org/wg/spring/charter/	Working Group Documents http://datatracker.ietf.org/wg/spring/
Cloud SDN	Area	Security	IETF	Security Area	The Security Area is the home for working groups focused on security protocols. They provide one or more of the security services: integrity, authentication, non-repudiation, confidentiality, and access control. Since many of the security mechanisms needed to provide these security services employ cryptography, key management is also vital.	Relevant Working Groups abfab Application Bridging for Federated Access Beyond web dane

					[IETF Areas]	<p>DNS-based Authentication of Named Entities</p> <p>httpauth Hypertext Transfer Protocol Authentication</p> <p>kitten Common Authentication Technology Next Generation</p>
Cloud SDN	Working Group	Security	IETF	abfab Application Bridging for Federated Access Beyond web	Federated identity facilitates the controlled sharing of information about principals, commonly across organisational boundaries. This avoids redundant registration of principals who operate in multiple domains, reducing administrative overheads and improving usability while addressing privacy-related concerns and regulatory and statutory requirements of some jurisdictions. A number of such mechanisms are in use for the Web. This working group will specify a federated identity	<p>Working Group Documents</p> <p>http://datatracker.ietf.org/wg/abfab/</p>

					<p>mechanism for use by other Internet protocols not based on HTML/HTTP, such as for instance IMAP, XMPP, SSH and NFS. The design will combine existing protocols, specifically the Extensible Authentication Protocol (EAP - RFC 3748), Authentication, Authorization and Account Protocols (RADIUS - RFC 2865 and Diameter - RFC 3588), and the Security Assertion Markup Language (SAML).</p> <p>http://datatracker.ietf.org/wg/abfab/charter/</p>	
Cloud SDN	Working Group	Security	IETF	dane DNS-based Authentication of Named Entities	<p>Specify mechanisms and techniques that allow Internet applications to establish cryptographically secured communications by using information distributed through DNSSEC for discovering and authenticating public keys which are associated with a service located at a domain name.</p> <p>http://datatracker.ietf.org/wg/dane/charter/</p>	<p>Working Group Documents</p> <p>http://datatracker.ietf.org/wg/dane/</p>
Cloud SDN	Working Group	Security	IETF	httppath Hypertext Transfer	<p>Authentication of users to servers over HTTP has always been a weak point in web services. The current HTTP authentication mechanisms,</p>	<p>Working Group Documents</p> <p>http://datatracker.ietf.org/wg/httppath/</p>

				Protocol Authentication	<p>basic and digest, pass the credentials in the clear or employ weak algorithms and are considered to be insecure today. Authentication through non-standard web forms is much more commonly used, but also pass the credentials in the clear. There is a need for improved mechanisms that can replace or augment HTTP authentication without the need to rely on transport layer security. Only HTTP authentication is in scope for this WG; form-based or "web" authentication is out of scope.</p> <p>http://datatracker.ietf.org/wg/httpauth/charter/</p>	f.org/wg/httpauth/
Cloud SDN	Working Group	Security	IETF	kitten Common Authentication Technology Next Generation	<p>The purpose of the Common Authentication Technology Next Generation (Kitten) working group (WG) is to develop extensions/improvements to the GSS-API and to the Kerberos authentication system, shepherd specific GSS-API security mechanisms, and provide guidance for any new SASL-related submissions.</p> <p>http://datatracker.ietf.org/wg/kitten/charte</p>	<p>Working Group Documents</p> <p>http://datatracker.ietf.org/wg/kitten/</p>

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Cloud SDN	Area	Transport	IETF	Transport Area	<p>The transport and services area - usually just called "transport area" or "TSV area" - covers a range of technical topics related to data transport in the Internet.</p> <p>The Transport Area works on mechanisms related to end-to-end data transport to support Internet applications and services that exchange potentially large volumes of traffic at potentially high bandwidths. A key focus are mechanisms to detect and react to congestion in the Internet, such as the congestion control algorithms in Internet transport control protocols such as TCP, SCTP, and DCCP, as well as congestion management schemes such as PCN and CONEX.</p> <p>[IETF Areas]</p>	<p>Relevant Working Groups</p> <p>alto Application-Layer Traffic Optimization</p> <p>cdni Content Delivery Networks Interconnection</p> <p>storm STORage Maintenance</p>
Cloud SDN	Working Group	Transport	IETF	alto Application-Layer Traffic Optimization	<p>A significant part of the Internet traffic today is generated by peer-to-peer (P2P) applications used for file sharing, real-time communications, and live media streaming. P2P applications exchange large amounts of data, often uploading as</p>	<p>Working Group Documents</p> <p>http://datatracker.ietf.org/wg/alto/</p>

					<p>much as downloading. In contrast to client/server architectures, P2P applications often must choose one or more suitable candidates from a selection of peers offering the same resource or service.</p> <p>http://datatracker.ietf.org/wg/alto/charter/</p>	
Cloud SDN	Working Group	Transport	IETF	cdni Content Delivery Networks Interconnection	<p>A Content Delivery Network (CDN) is an infrastructure of network elements operating at layer 4 through layer 7, arranged for the efficient distribution and delivery of digital content. Such content includes, but is not limited to, web pages and images delivered via HTTP, and streaming of continuous media delivered via HTTP, RTSP, RTMP, etc. CDNs typically provide services to multiple Content Service Providers (CSPs).</p> <p>http://datatracker.ietf.org/wg/cdni/charter/</p>	Working Group Documents http://datatracker.ietf.org/wg/cdni/
Cloud SDN	Working Group	Transport	IETF	storm STORage Maintenance	<p>The IETF IPS (IP Storage) and RDDP (Remote Direct Data Placement) working groups have produced a significant number of storage protocols (e.g., iSCSI, iSER and FCIP) for which there is significant usage. The time has come to reflect feedback from implementation and usage into</p>	Working Group Documents http://datatracker.ietf.org/wg/storm/

					<p>updated RFCs; this work may include:</p> <ul style="list-style-type: none"> - Implementation-driven revisions and updates to existing protocols (i.e., updated RFCs that match the "running code"). - Interoperability reports as needed for the resulting revised protocols that are appropriate for Draft Standard RFC status. - Minor protocol changes or additions. Backwards compatibility is required. <p>http://datatracker.ietf.org/wg/storm/charte r/</p>	
Cloud SDN	Working Group	Transport	IETF	Transport Area		Working Group Documents

There is other work going on in the community in the SDN and Cloud area. The entries below are from the IRTF (Internet Research Task Force) and non-working group email lists that have been formed to research, brainstorm and discuss various topics.

Activity domain	Stage (topic)	Area	Entity	Title of deliverable	Scope of deliverable	Current status
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Cloud SDN	Non-Working Group Mailing List	Management	IETF	openv6	<p>Discussion of an open interface and a programmable platform to support various IPv6 applications, which may include IPv6 transition technologies, SAVI (Source Address Validation and Traceback), security, data center and etc. This discussion will focus on the problem space, use case and possible protocol extensions.</p> <p>https://www.ietf.org/mailman/listinfo/openv6</p>	
Cloud SDN	Research	Applications Routing Transport	IRTF	ICNRG Information-Centric Networking Research Group	<p>Distributing and manipulating named information is a major application in the Internet today. In addition to web-based content distribution, other distribution technologies (such as P2P and CDN) have emerged and are promoting a communication model of accessing data by name, regardless of origin server location.</p> <p>In order to respond to increasing traffic volume in the current Internet for applications such as mobile video and cloud computing, a set of disparate technologies and distribution services are employed that employ caching, replication and content distribution in different specific ways. These approaches are currently deployed in separate silos – different CDN providers and P2P applications rely on proprietary</p>	<p>Current Work</p> <p>http://trac.tools.ietf.org/group/irtf/trac/wiki/icnrg</p>

				<p>distribution technologies. It is not possible to uniquely and securely identify named information independently of the distribution channel; and the different distribution approaches are typically implemented as an overlay, leading to unnecessary inefficiency.</p> <p>Information-centric networking (ICN) is an approach to evolve the Internet infrastructure to directly support this use by introducing uniquely named data as a core Internet principle. Data becomes independent from location, application, storage, and means of transportation, enabling in-network caching and replication. The expected benefits are improved efficiency, better scalability with respect to information/bandwidth demand and better robustness in challenging communication scenarios. These concepts are known under different terms, including but not limited to: Network of Information (NetInf), Named Data Networking (NDN) and Publish/Subscribe Networking.</p> <p>ICN concepts can be applied to different layers of the protocol stack: name-based data access can be implemented on top of the existing IP infrastructure, e.g., by</p>	
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					<p>providing resource naming, ubiquitous caching and corresponding transport services, or it can be seen as a packet-level internetworking technology that would cause fundamental changes to Internet routing and forwarding. In summary, ICN is expected to evolve the Internet architecture at different layers.</p> <p>http://irtf.org/icnrg</p>	
Cloud SDN	Research	Applications Routing Management Transport	IRTF	SDNRG Software-Defined Networking Research Group	<p>SDN aims to benefit all types of networks, including wireless, cellular, home, enterprise, data centers, and wide-area networks. The Software-Defined Networking Research Group (SDNRG) investigates SDN from various perspectives with the goal of identifying the approaches that can be defined, deployed and used in the near term as well identifying future research challenges. In particular, key areas of interest include solution scalability, abstractions, and programming languages and paradigms particularly useful in the context of SDN. In addition, it is an explicit goal of the SDNRG to provide a forum for researchers to investigate key and interesting problems in the Software-Defined Networking field.</p>	<p>Current Work</p> <p>http://trac.tools.ietf.org/group/irtf/trac/wiki/sdnrg</p>

					Finally, the SDNRG provides objective definitions, metrics and background research with the goal of providing this information as input to protocol, network, and service design to SDOs and other standards producing organizations such as the IETF, ETSI, ATIS, ITU-T, IEEE, ONF, MEF, and DMTF. http://irtf.org/sdnrg	
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References

[IETF] <http://www.ietf.org/> (accessed 16 February 2014)

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[IETF RFC Pages] <http://www.ietf.org/rfc.html> (accessed 16 February 2014)

[IETF Internet Draft Info] <http://www.ietf.org/id-info/> (accessed 16 February 2014)

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