



The Internet Ecosystem

How does the Internet really work?

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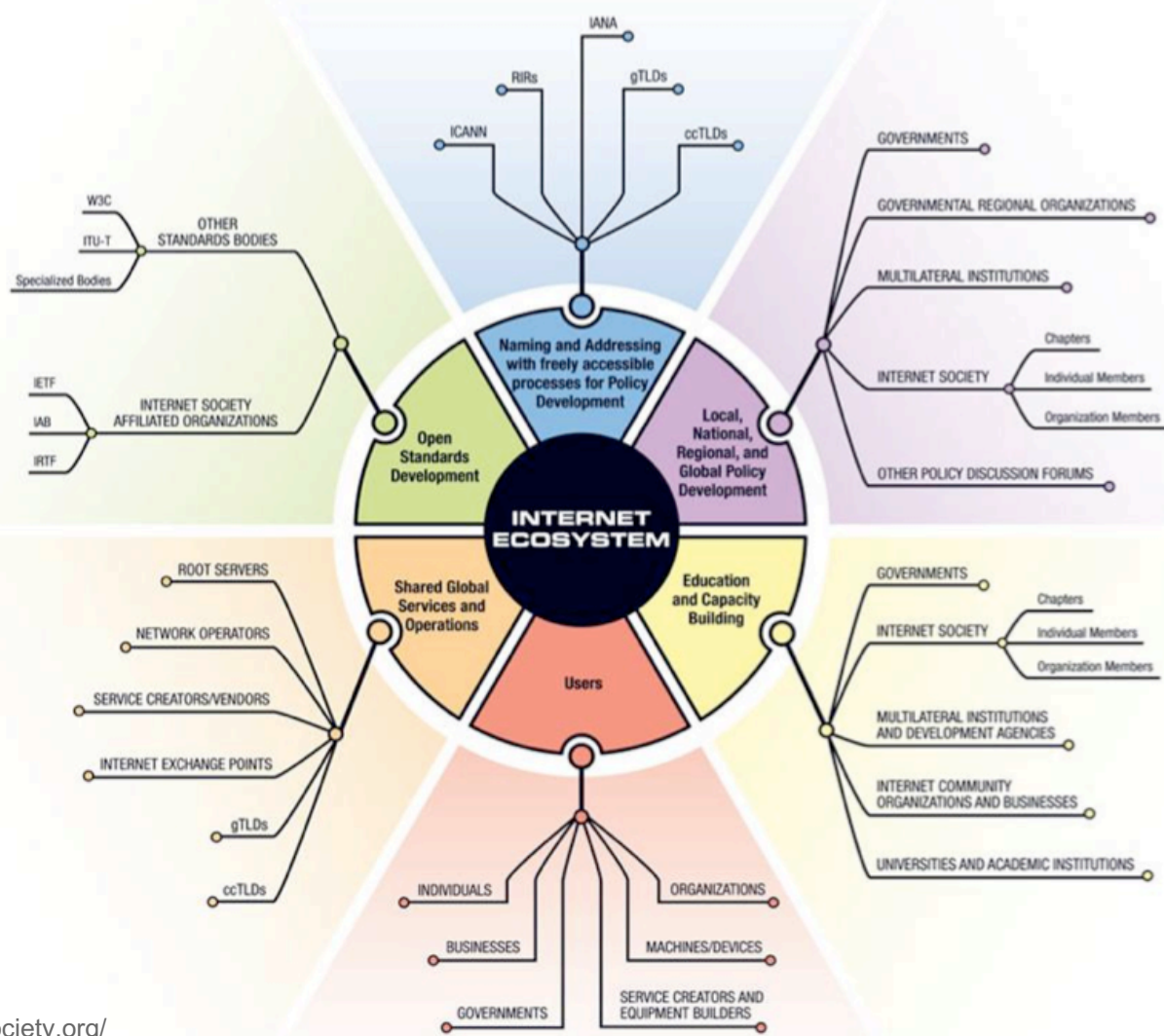
The 'Net

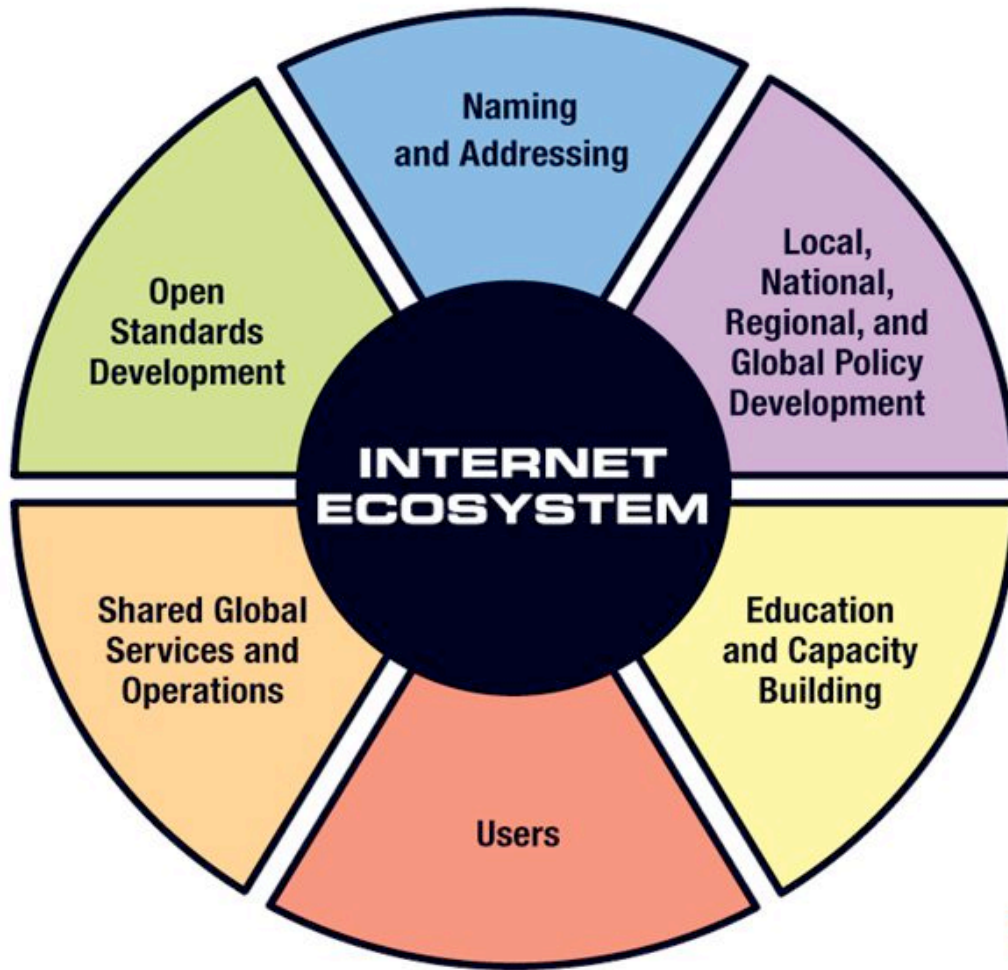


What are the business relationships that make the Internet work?

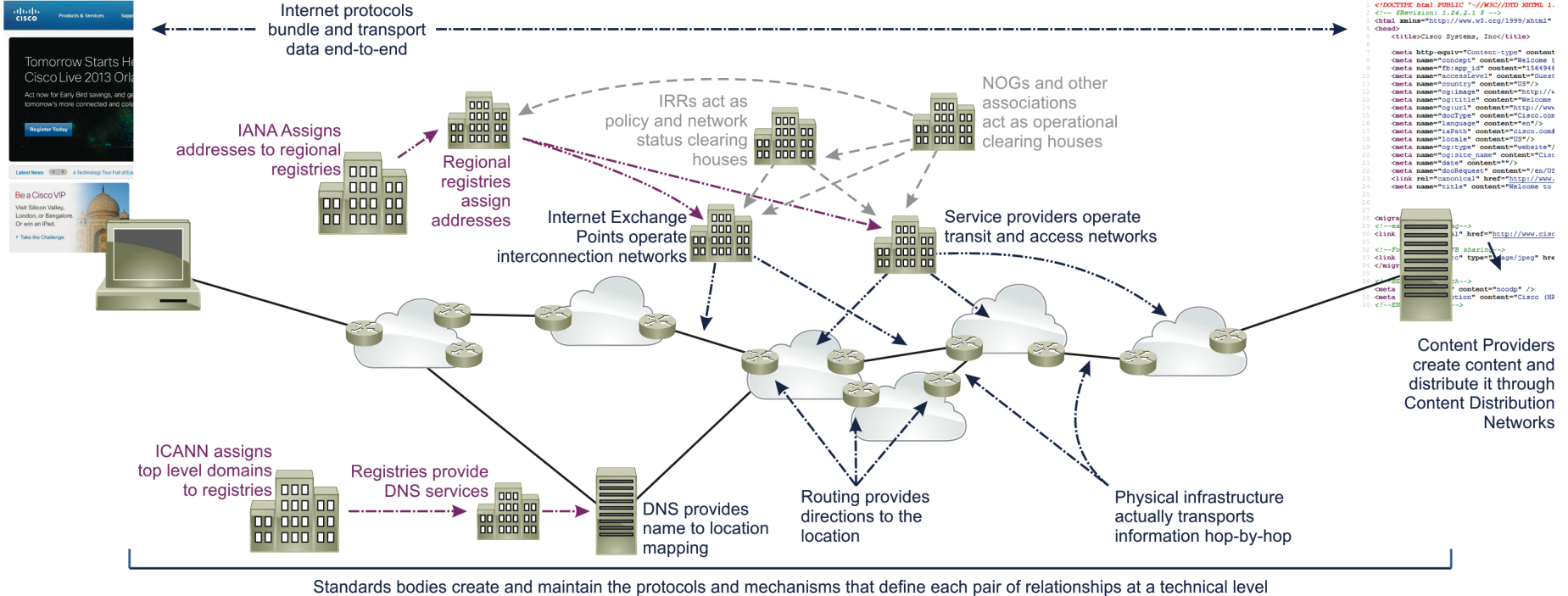
What are the protocols and parts that make the Internet work?







Internet

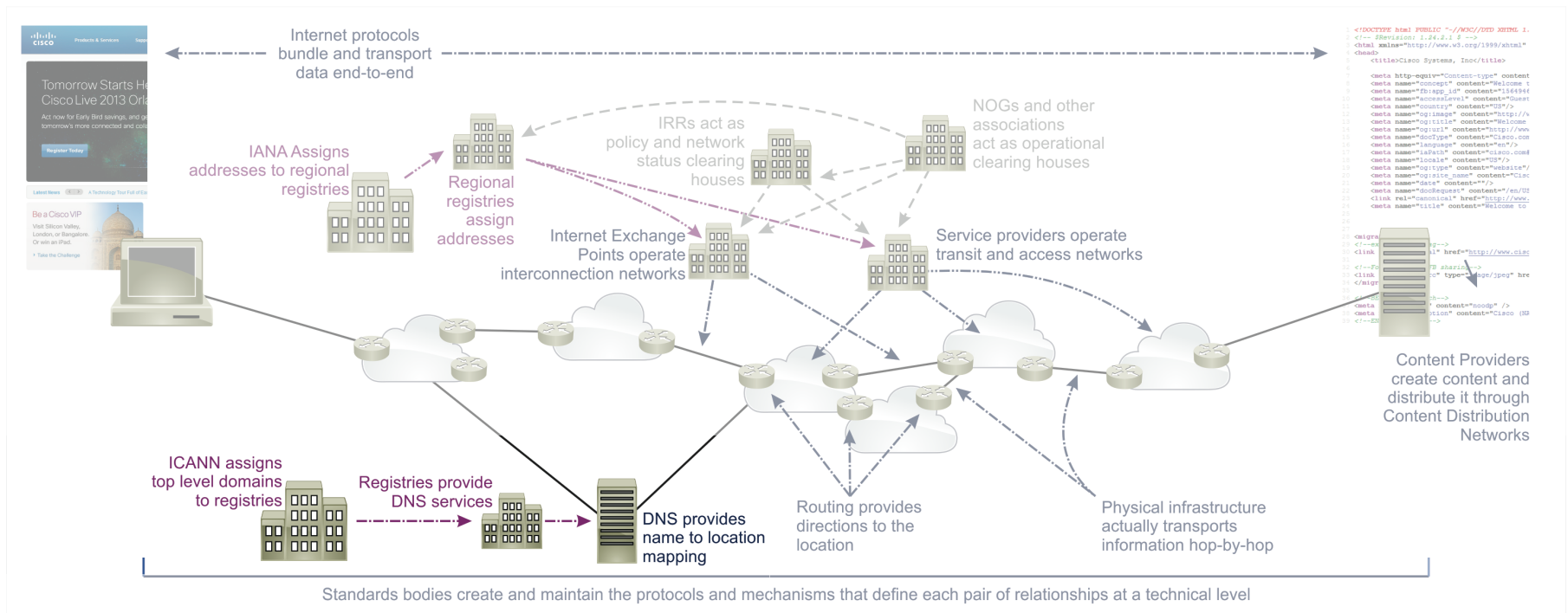


Agenda

- Technical Overview
 - Naming
 - Routing
- Architectural Overview
 - Standards
 - Service Providers
 - Registries
 - Clearing Houses

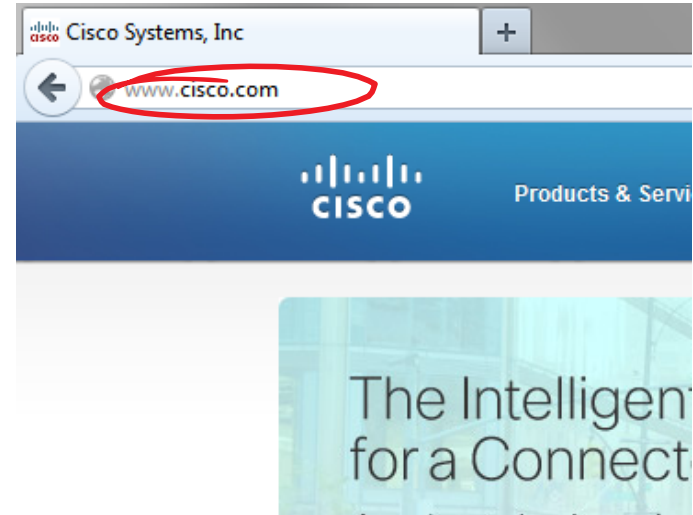
NAMING

Naming



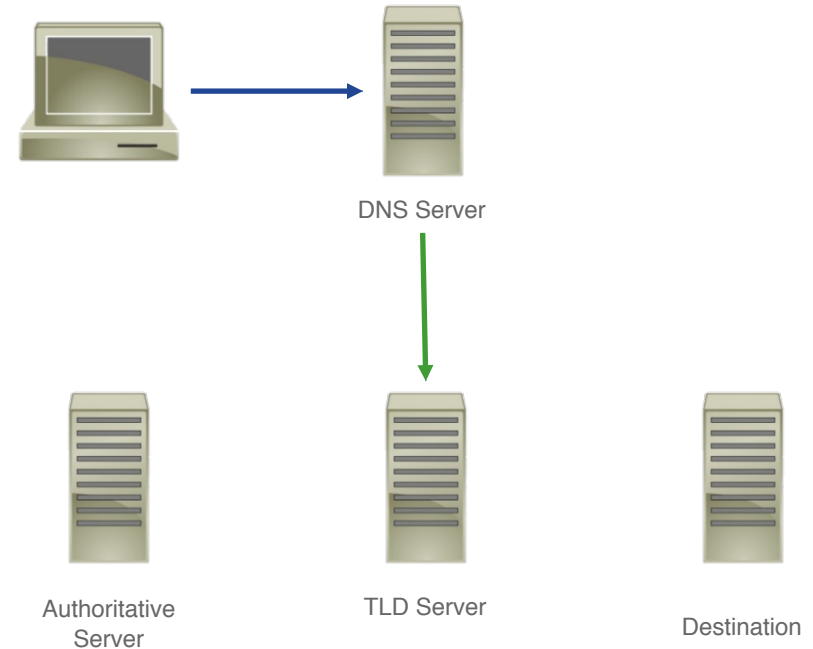
The Domain Name System

- Begin with a user who types the name of a web site into a browser
- How does the host actually find a web site based on a name?
- There are three things the host needs to find
 - An address for the server on which the information resides
 - How to get to that address
 - The specific file on the server itself
- DNS provides the first of these three bits of information



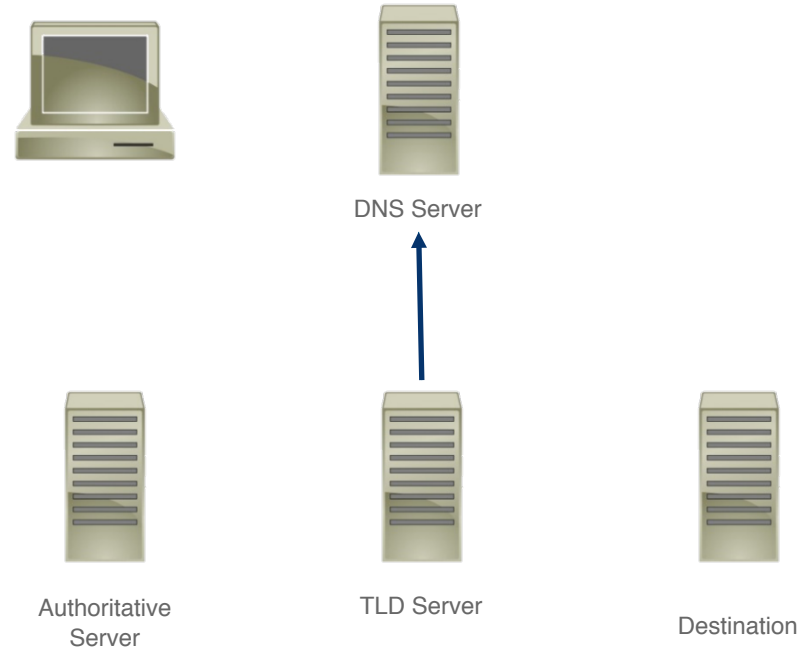
The Domain Name System

- The local DNS cache may contain the information.
- The TLD (Top Level Domain) server has information about domains.
 - cisco.com is a domain in the .com TLD.
- The authoritative server has information specific to a sub-domain.



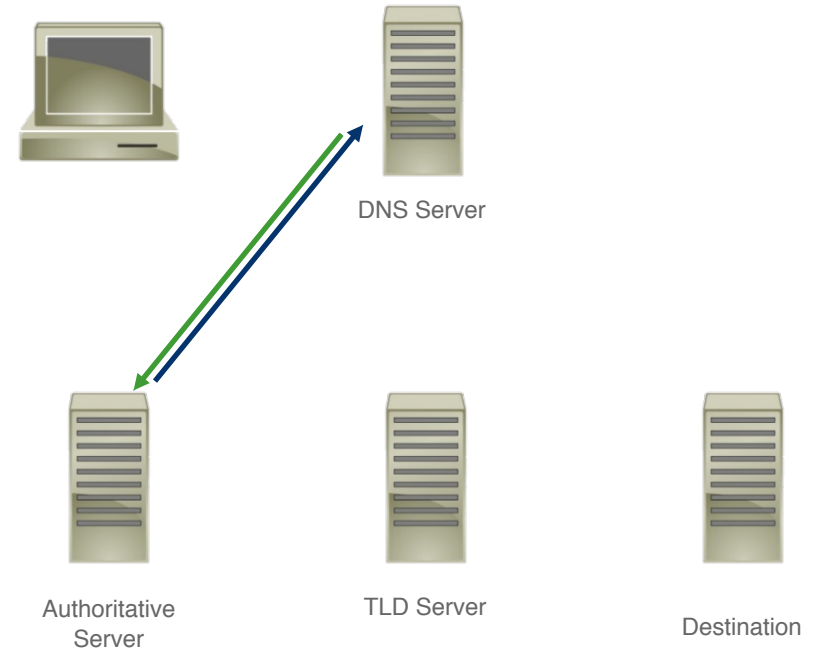
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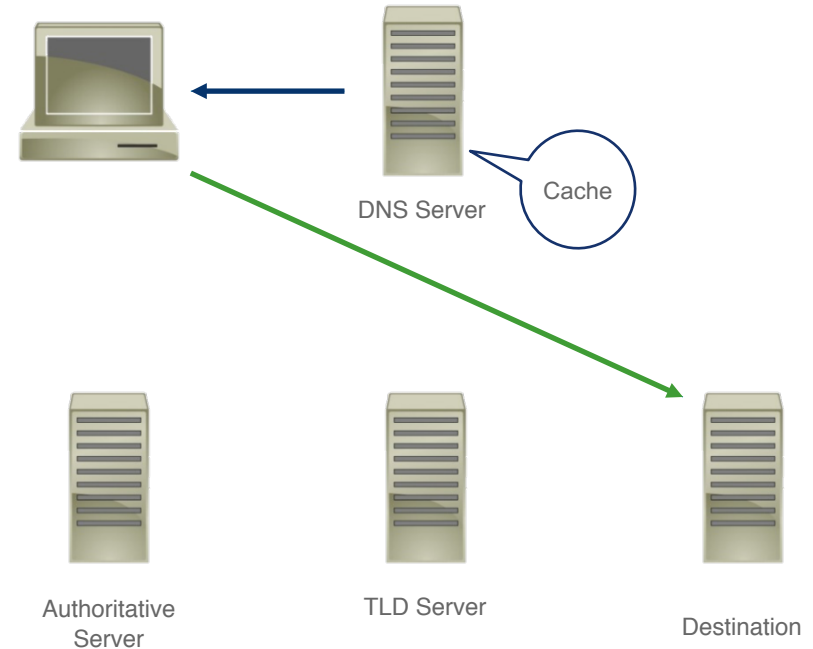
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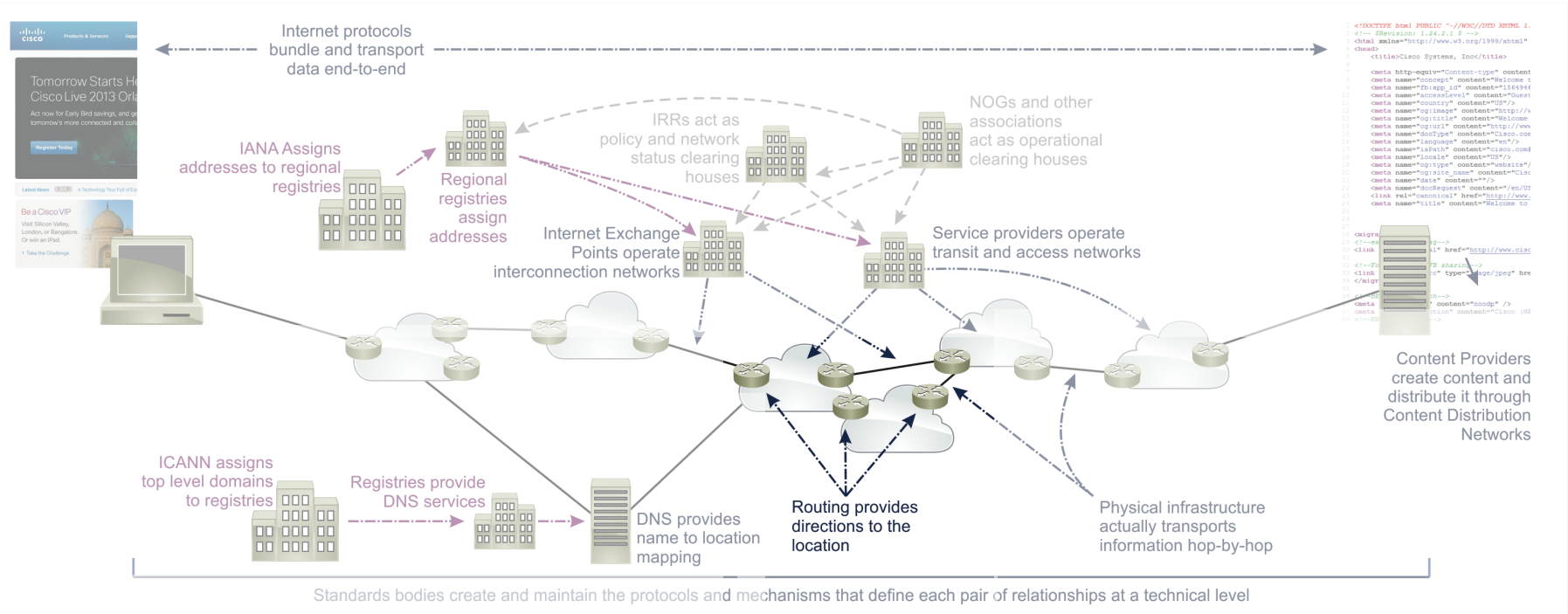
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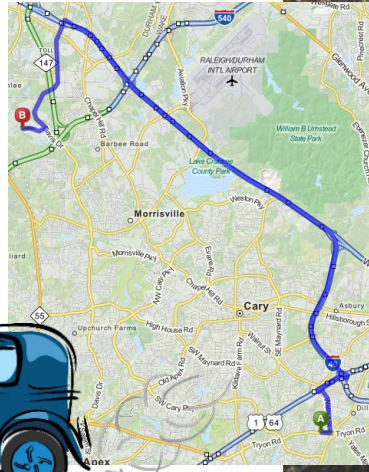
ROUTING

Routing



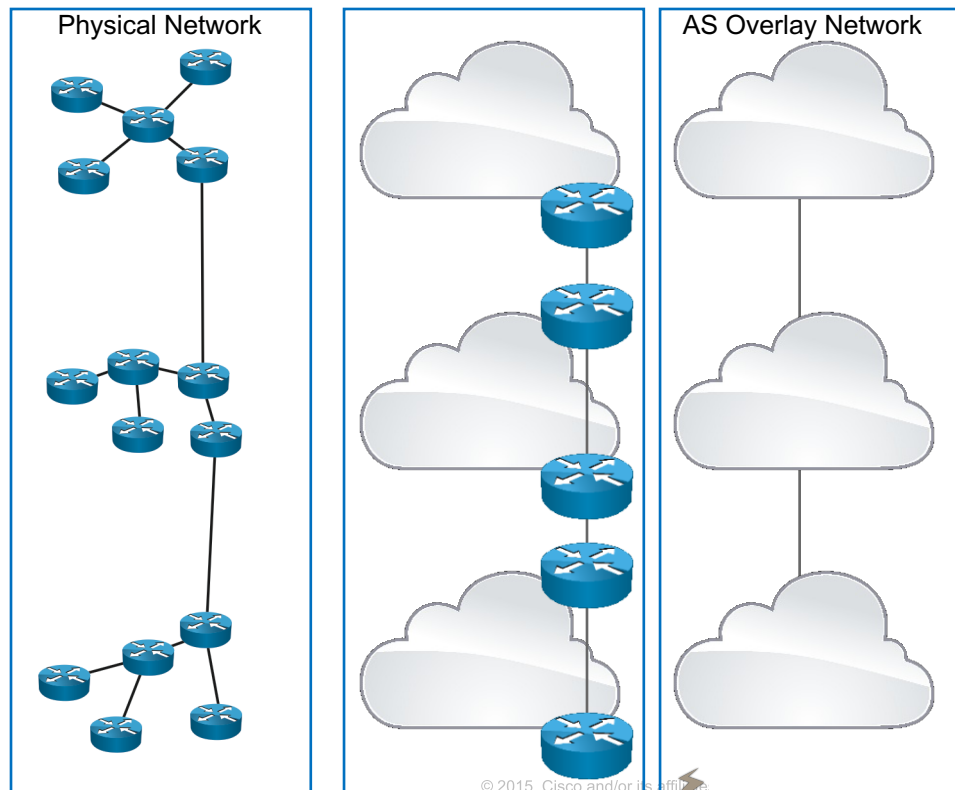
Routing

- Now we have an address that tells us where to find the web site we're after...
- And we have a way to bundle the data that needs to be transferred...
- But how do we get there?



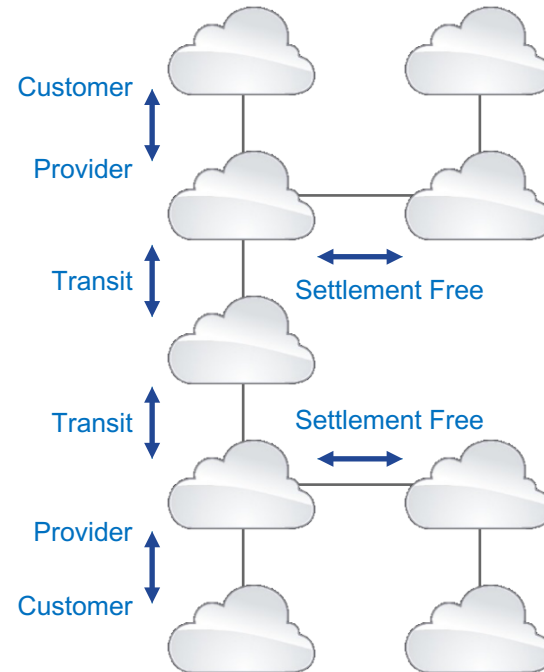
Routing

- It's easy to say “the Internet is a network of networks,” but what does that really mean?
- Another way to view the Internet is as a virtual topology
- Policy is the key to understanding the AS level (overlay network)
 - BGP is *distributed policy*
 - Different types of providers follow different sets of policies to maximize revenue and minimize cost



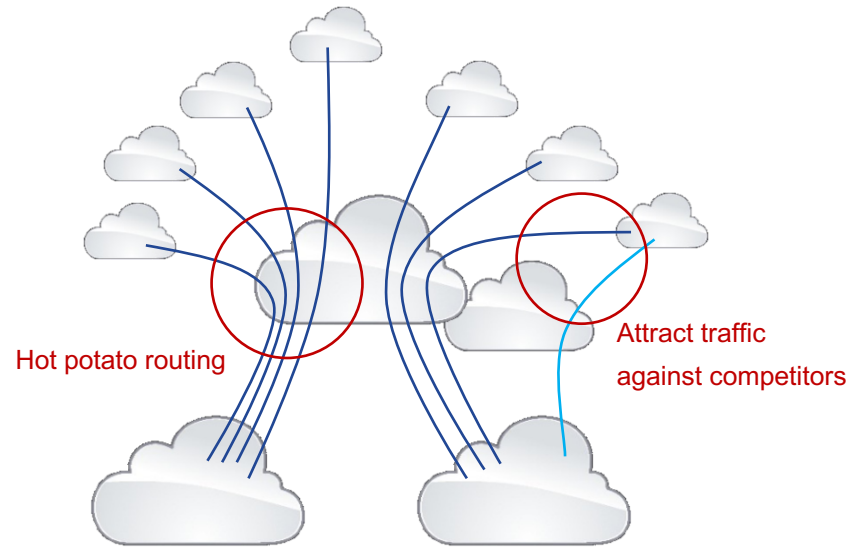
Peering Connections

- Understanding these policies requires understanding peering models
- Provider/Customer
- Transit
- Settlement Free



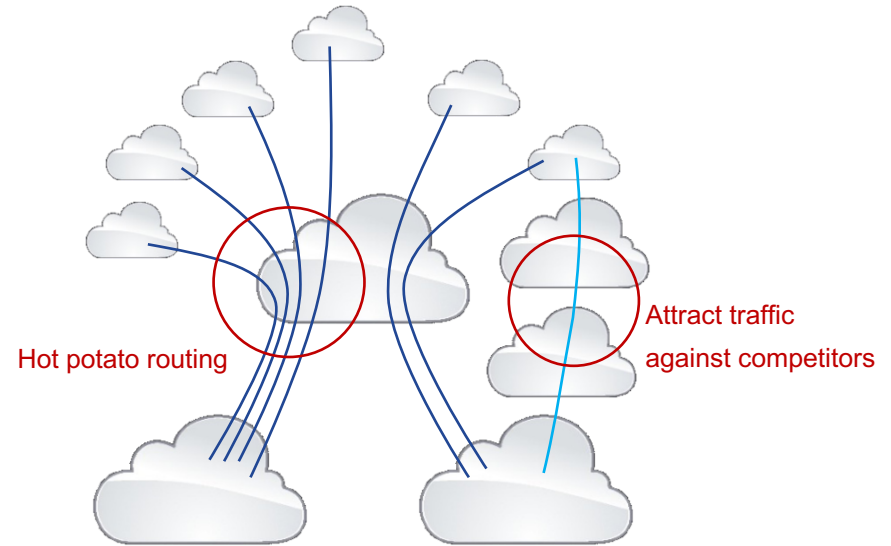
Edge Provider Routing Policy

- Be the preferred path for connected customers
 - Even if they're connected to someone else
- Carry traffic across the shortest possible path
 - Or for the least amount of time possible
 - “Hot potato routing”



Transit Provider Routing Policy

- Attract as much traffic as possible
 - Increasing peering to reduce the AS Path length to reach any particular destination
- Carry as little traffic as possible
 - Really carrying packets for the shortest distance you can
 - “Hot potato routing”

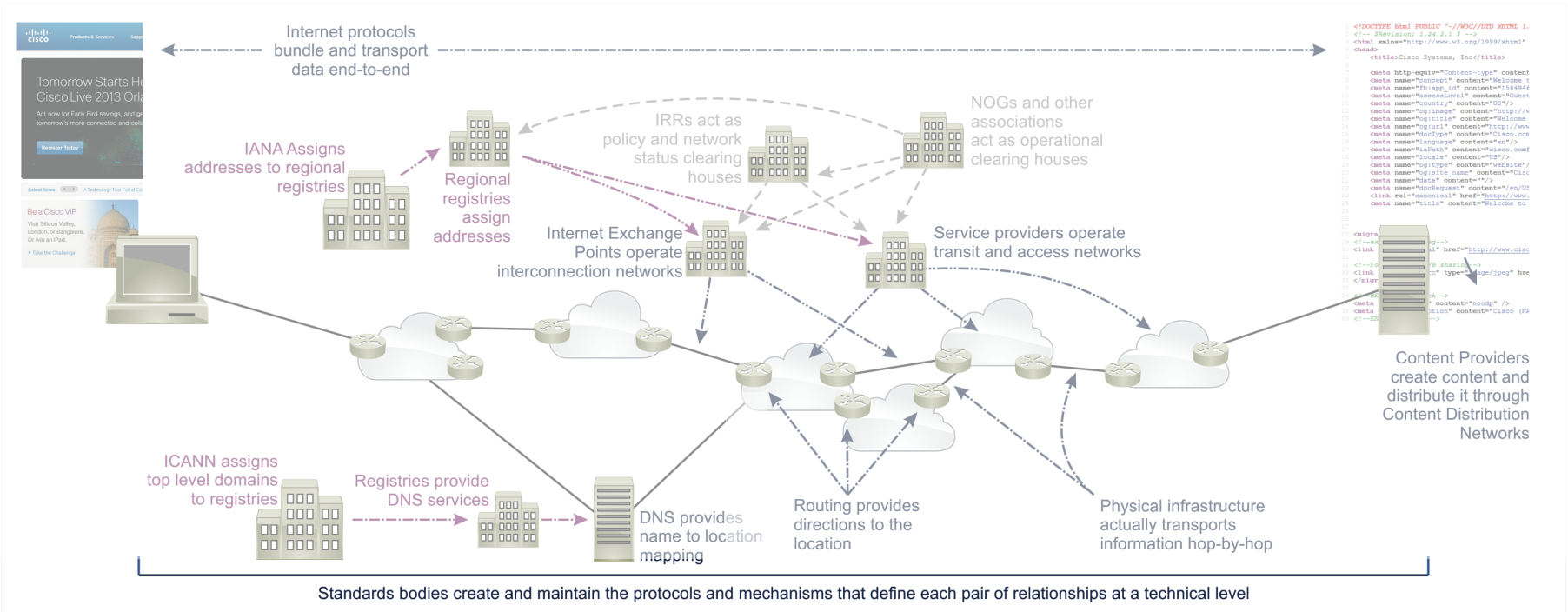


Content Provider Routing Policy

- Push content as close to the actual “eyeballs” as possible
 - Peer as widely as possible
 - Use content distribution mechanisms to push content to every corner/edge of the network
- Carry traffic on internal links where possible
 - To exert the greatest level of control over the user’s experience on your services
 - “Cold potato routing”

STANDARDS BODIES

Standards Organizations



Standards Organizations



All layer 3 transport and routing protocols, including IP, TCP, UDP, HTTP, DNS, routing protocols, telnet, rsync, IPsec, and network management protocols



All layer 1 and layer 2 transport and control plane protocols, including Ethernet, spanning tree, and wireless networking



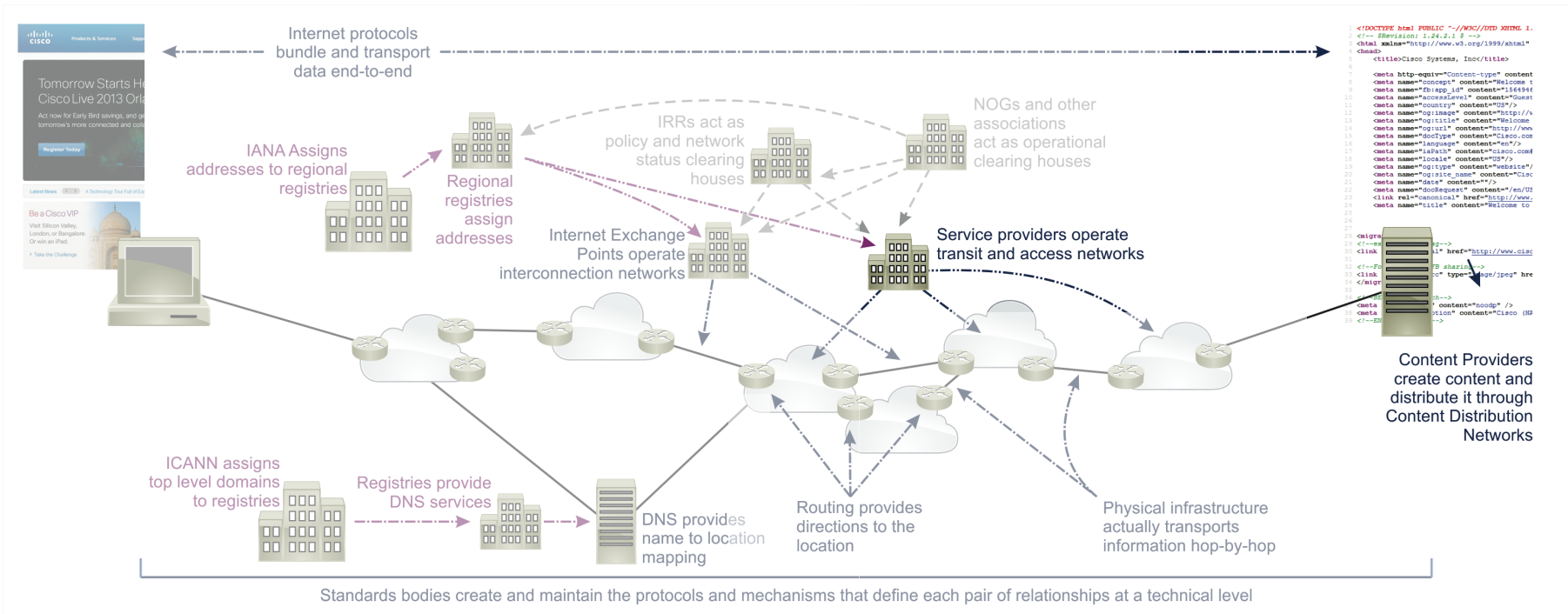
Markup languages (languages which describe how to display or render content), including HTML and XML



Any international standard, including numbering, encryption schemes, and routing protocols (such as IS-IS)

SERVICE PROVIDERS

Service Providers



Content Provider Overview

- Content providers fall into two categories
 - Media creation and distribution
 - Connecting buyers and sellers (ecommerce)
- Sell services/entertainment or connect buyers to sellers.
 - User attention (advertising).

	Ecommerce, entertainment, information
	Search, services, software (ecommerce)
	Search, services, entertainment
	Entertainment
	Services, information, ecommerce
	Entertainment
	Entertainment
	Ecommerce

Access Provider Overview

- Provide individual users, businesses, and organizations with Internet connections
- Are often involved in the creation and distribution of content, as well



Wireless services, business Internet access



High speed Internet access



Satellite based Internet access



Wireless Services



Wireless Services



High Speed Internet Access

Transit Provider Overview

- Provide interconnection between content and access service providers

Level(3)
COMMUNICATIONS

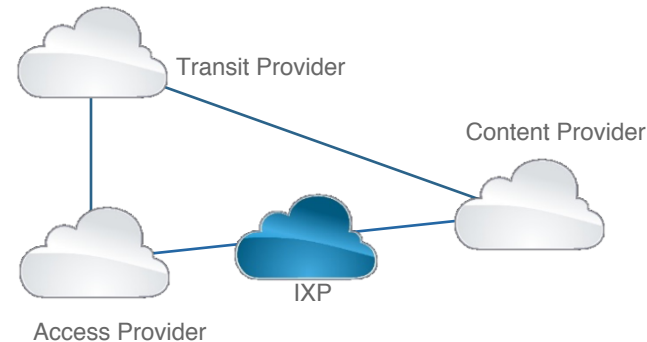
Telefonica

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Sprint 

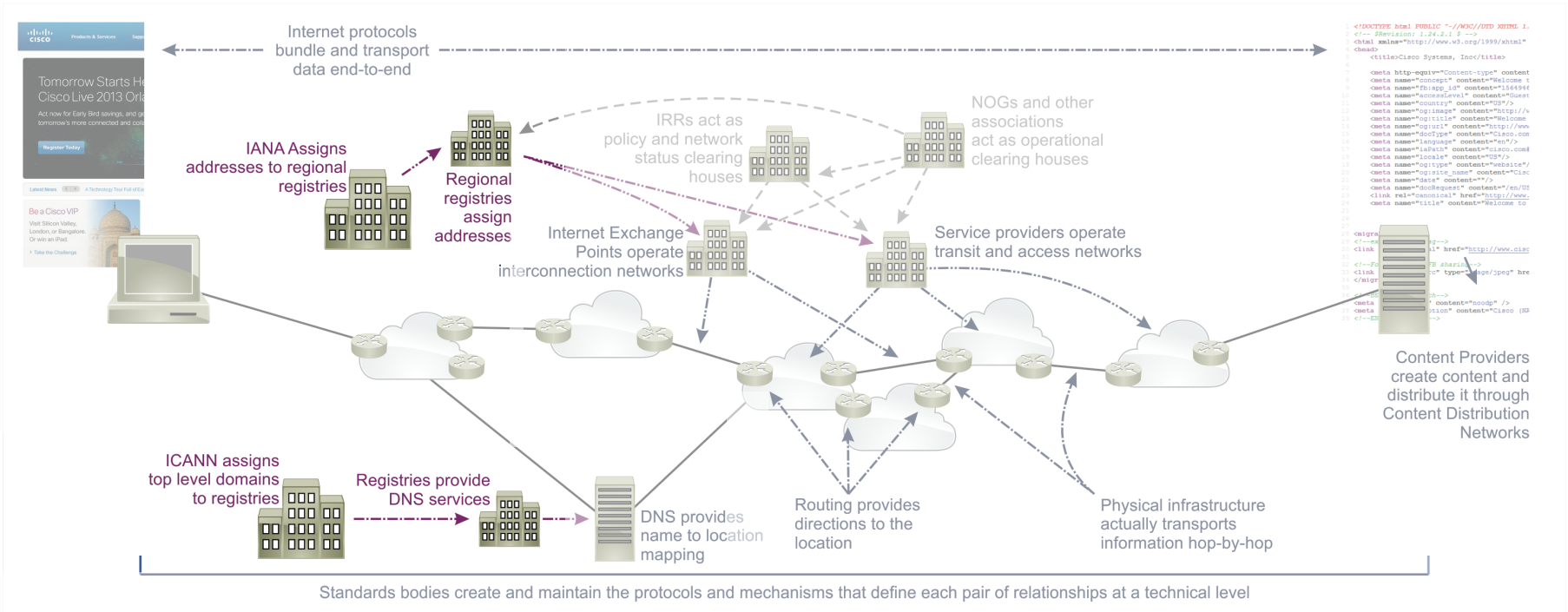
Internet Exchange Point Overview

- Internet Exchange Points (IXPs) provide local interconnections for access and content providers
 - IXPs can either be commercial or non-profit
- Used by providers within a region
 - Avoids the use of out of region transit providers
 - Reduces latency within the region
 - Replaces traffic based settlement costs with fixed membership fees



REGISTRIES

Registries



Naming Authorities

- ICANN and IANA coordinate the assignment of the numbers and names that make the Internet work
 - They only set the rules under which other organizations may obtain these resources
- IANA manages much more than the IP address space



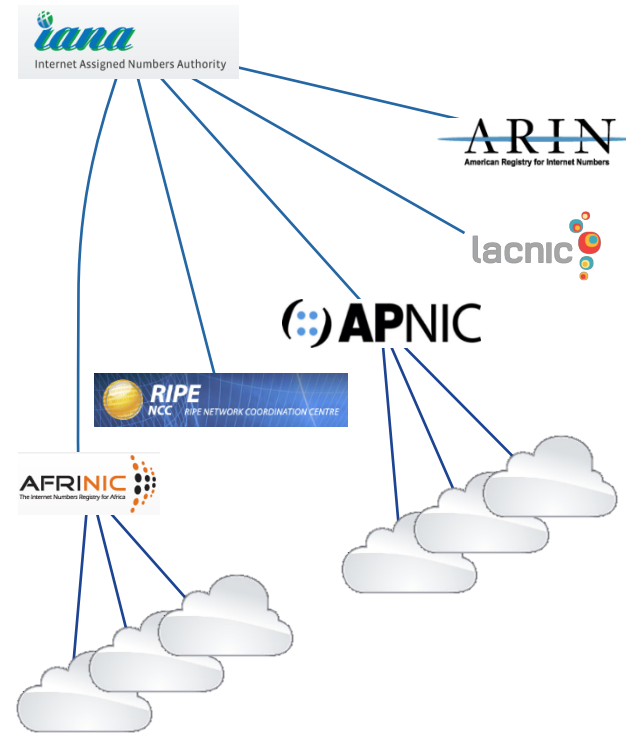
Regional Registry Overview

- Regional Internet Registries (RIRs) manage IP address block assignments for a region
- RIRs also...
 - Participate in research and standardization efforts
 - Provide services for the “common good” of their members, such as *whois*
 - Hold regular meetings for the education of their members and information exchange
 - Produce best common practice documents and recommendations



Regional Registry Overview

- IANA provides blocks of IP addresses to each RIR
 - Delegation is primarily based on need
- Each regional registry then provides address blocks to their members
 - The members can then advertise this space in the global routing table, use them in DNS entries, or even use them just for their internal networks



Top Level Registries

- Domain Name Registries manage Top Level Domains (TLDs)
 - ICANN assigns the management of these TLDs to these registries
 - These registries, in turn, sell domain names to second level registries
 - The ccTLDs (Country Code TLDs) represent a country of geographic territory.



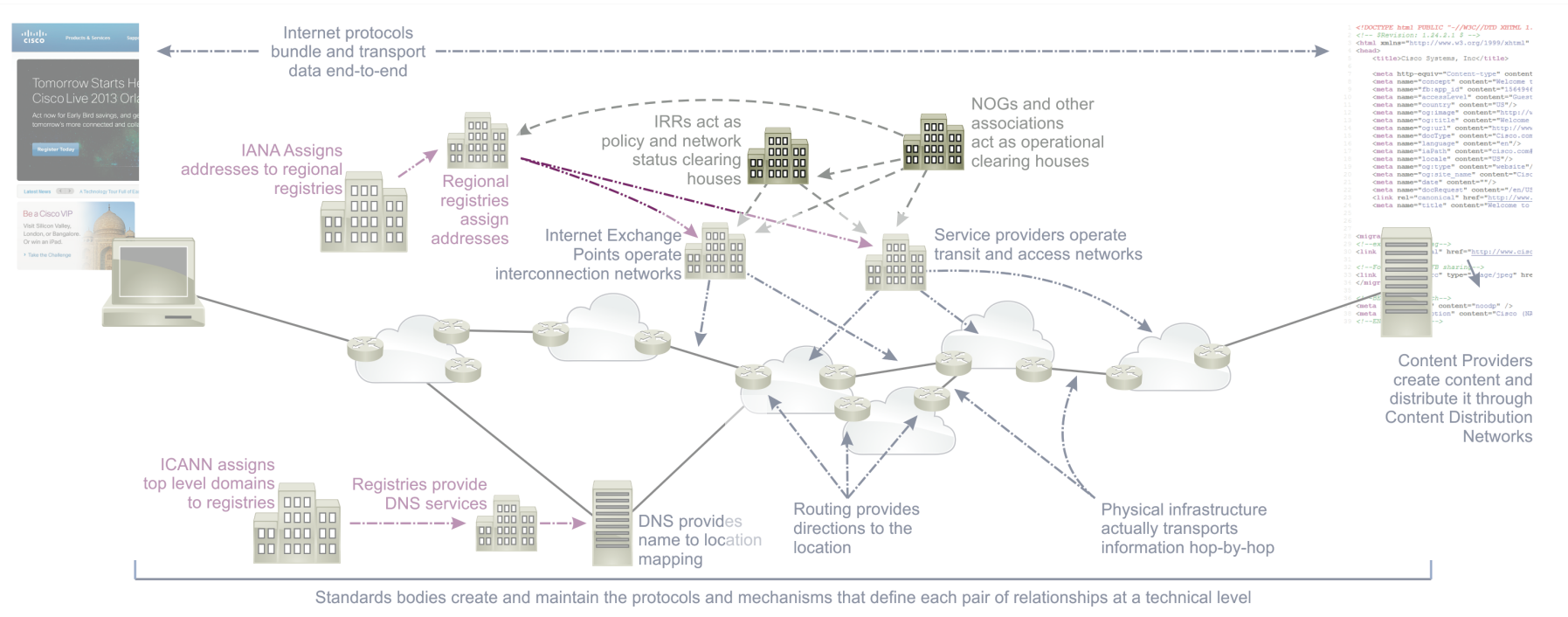
Second Tier Registries

- Domain resellers
 - Buy domains at a fixed rate from a TLD registry
 - Resell domains based on popularity, bundled into other services, etc.



OTHER ENTITIES

Clearing Houses



Internet Route Registries

- Internet Routing Registries (IRRs) are cooperative databases
 - Often run through volunteer efforts, by registries, and by research organizations
 - RIPE, APNIC, ARIN, EasyNet, Level3, and others all run IRR mirrors
 - Data is held in a common policy language standardized by the IETF, RPSL
- What is this information used for?
 - A large number of service providers won't accept route advertisements (through BGP) unless there is an existing entry in an IRR they recognize as authoritative
 - Service providers built route filters based on the information in the IRR databases

Internet Route Registries

- The policy information contained in the IRR can include
 - The origin AS
 - The prefix length, longest prefix length, and covered prefixes
 - Filtering policies implemented by a particular AS
 - Whether or not a peering AS is transit or not
- This information is stored in Routing Policy Specification Language (RPSL)
 - RPSL is defined in RFC2622

Network Operators Groups

- Network Operator's Groups (NOGs) act as clearing houses for information about network operations
 - These are generally volunteer organizations
 - Often run in close connection with regional registries, research organizations, vendors, and other regional organizations





The Internet Society engages in a wide spectrum of Internet issues, including policy, governance, technology, and development. We establish and promote principles that are intended to persuade governments to make decisions that are right for their citizens and each nation's future. Everything we do is based on ensuring that a healthy, sustainable Internet is available to everyone – today and for the next billion users.

The Internet Society (<http://www.internetsociety.org>)

Summary

- The Internet is made up of a collection of informal relationships, both related to technology and business.
- It is important to understand the interaction between all the parts and how they complement each other and contribute to a complete system.



Q&A



CISCO

TOMORROW starts here.