INTERNET ORGANIZATION

OVERVIEW OF THE INTERNET'S ORGANIZATION AND MAIN STANDARD BODIES

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Contents

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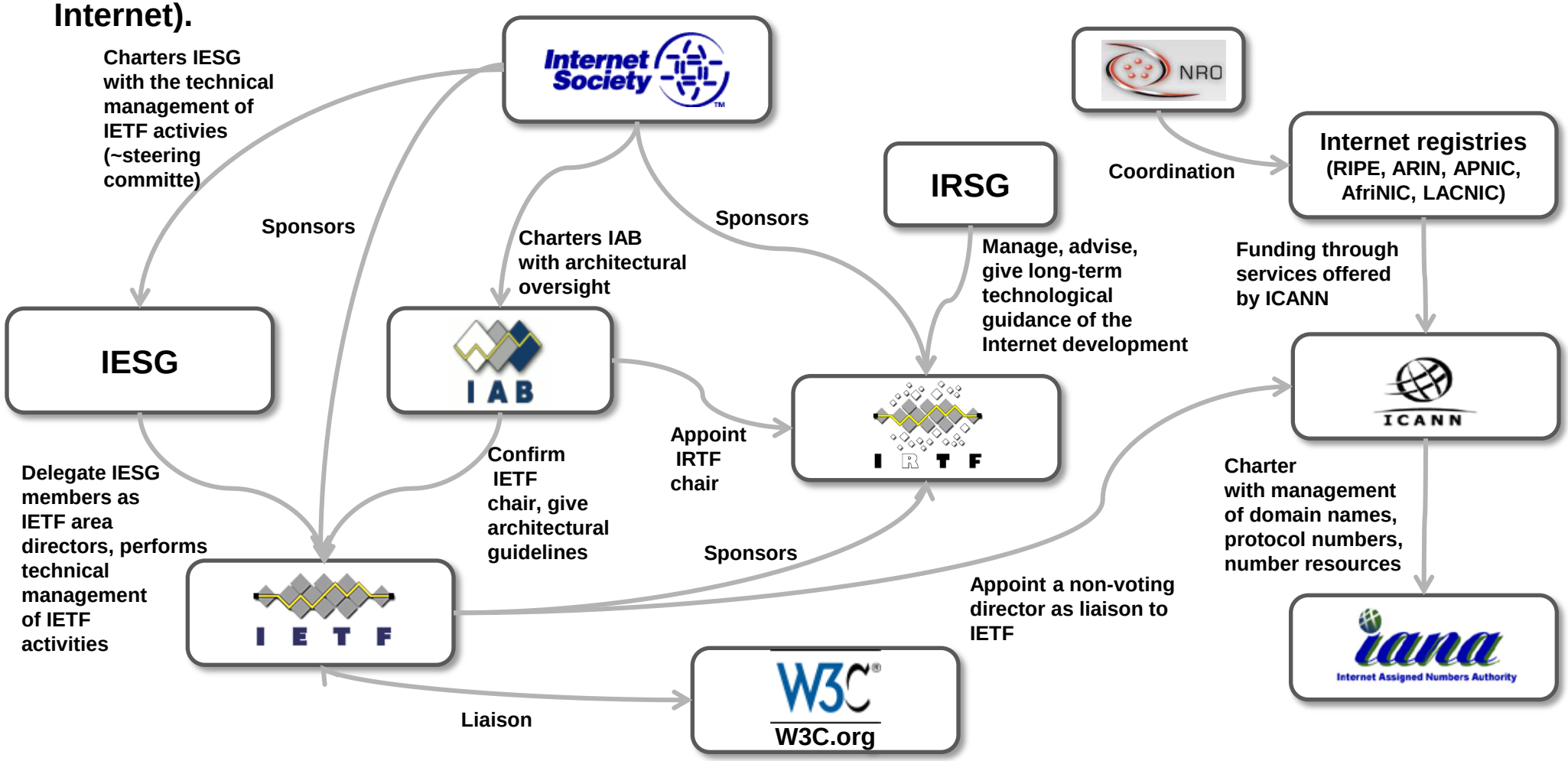
1. Internet Organizations (1/4)

A number of loosely coupled organizations are concerned with governing the development of the Internet.

There is no strict hierarchy in these organizations (non-hierarchy is a core principle of the Internet).



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1. Internet Organizations (2/4)

ISOC - Internet Society:

ISOC is concerned with the long-term coordination of the Internet development.
ISOC is a kind of a legal umbrella organization for the various organizations.

IETF – Internet Engineering Task Force:

IETF is a an open international community of network professionals and experts.
The mission of IETF is to produce high quality technical documents (standards as RFCs) for improving the Internet's quality and performance.
One of the main duties of IETF is the editorial management of internet drafts before they become RFCs (each draft is assigned to and managed by an RFC editor).

ICANN – Internet Corporation for Assigned Names and Numbers:

ICANN (formerly InterNIC) is an internationally organized non-profit organization under Californian right.
The responsibilities of ICANN are:
a. IP address space allocation
b. gTLD (generic Top Level Domain) and ccTLD (country code TLD) DNS management (ICANN is the body that decides about the introduction of new TLDs)
c. Root server system management
d. Protocol identifier assignment
While ICANN bears the responsibility for the tasks listed above, its sub-organization IANA actually does the management of these. ICANN is funded by the services it provides to the different internet registries.

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1. Internet Organizations (3/4)

IANA – Internet Assigned Numbers Autority:

IANA is the predecessor organization of ICANN. IANA still exists and now is an organization that actually manages the different duties of ICANN, namely the TLD, protocol number, IP address and AS number management.

IAB – Internet Architecture Board:

The IAB is responsible for the architecture and protocol development oversight. It is responsible for the Internet architecture as a whole with respect to aspects like scalability, openness of standards and evolution of the Internet architecture. While IETF is responsible for the IETF draft and RFC management, IAB oversees this activity and is the appeal board in case of complaints. IAB is a member of ISOC.

IESG - Internet Engineering Steering Group:

IESG carries out the technical management of IETF activites and the Internet standards process.

IRTF – Internet Research Task Force:

IRTF conducts research on protocols, applications, architecture and technology.

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1. Internet Organizations (4/4)

IRSG – Internet Research Steering Group:

The IRSG is responsible for steering the IRTF and provide good conditions for research carried out by IRTF.

W3C – World Wide Web Council:

W3C develops web technology standards.
W3C is not directly related to IETF, IAB or ISOC.

RIR - Regional Internet Registries:

RIRs are responsible for the management and allocation of Internet number resources, namely IP addresses and AS numbers.
There are 5 RIRs, each responsible for a region in the world:

RIPE:	**Europe**	**ARIN:**	**America**
APNIC:	**Asia**	**AfriNIC:**	**Africa**
LACNIC:	**Latin America**		

NRO (Number Resource Organization) is a coordinating body for the efforts of the five RIRs.

Control of the Internet:

ICANN has been opened to international participation, but the Internet is still largely controlled by US Dept. of Commerce. ICANN is the most important organization since it has most power in the Internet management.
The standards process governed by IETF is fully open and everybody can participate and contribute to the development of the Internet.

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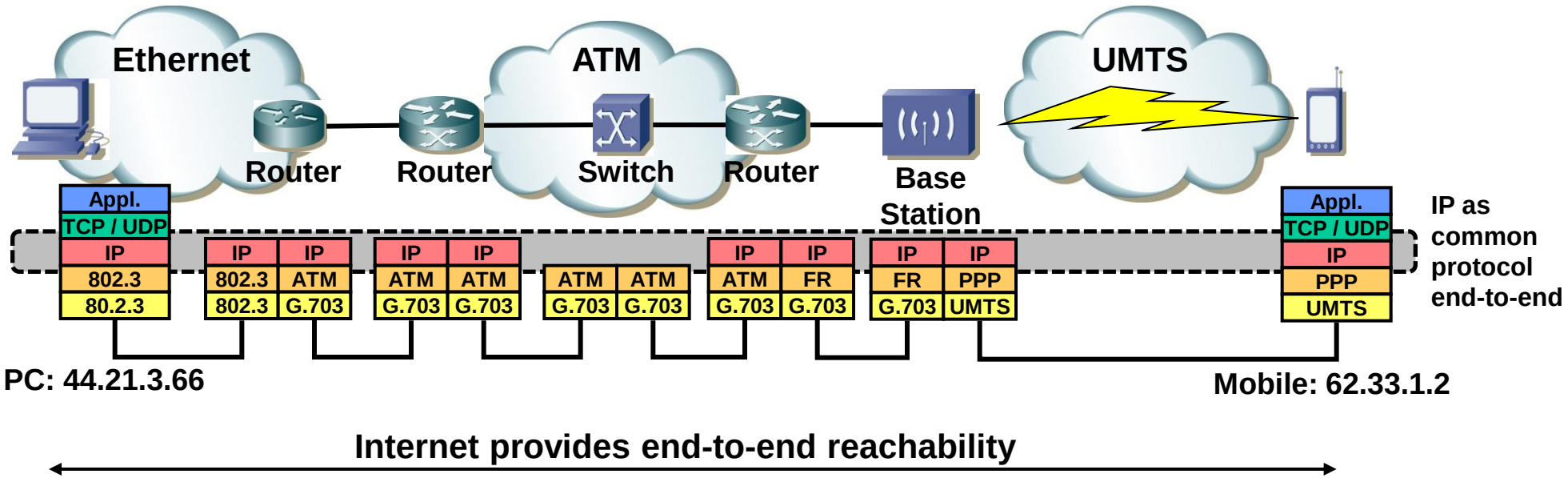
2. Why the Internet is called Inter-net (1/2)

The Internet inter-connects different physical networks (802.3, wireless etc.).
TCP/IP serves as the convergence protocol.

The IP protocol provides end-to-end addressing.



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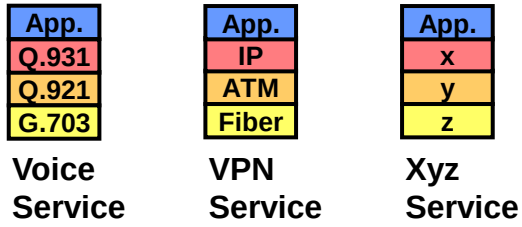
2. Why the Internet is called Inter-net (1/2)

Everything over IP, IP over everything:

In legacy protocol technologies, every service has its own protocol stack.
Connecting such dissimilar stacks is very difficult and requires the use of protocol gateways.

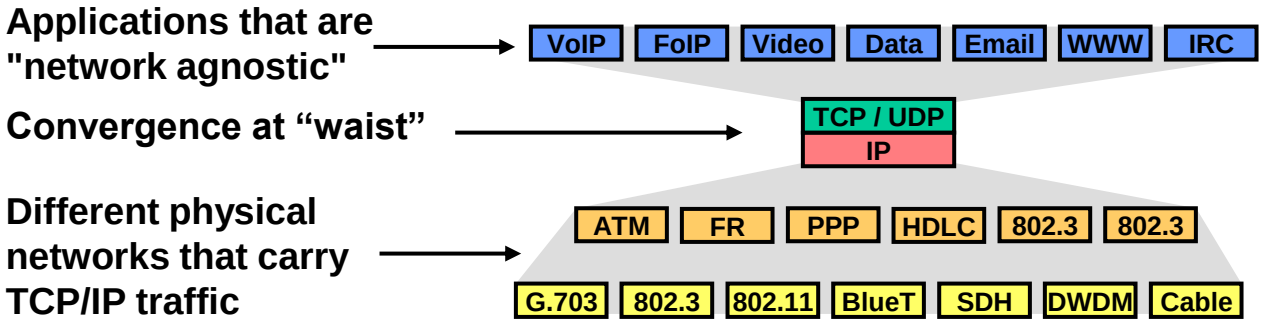
Legacy "Stovepipe" / "Silo" model (obsolete):

Every service has its own stack.



In the TCP/IP model, any application layer protocol can be run over TCP/IP.
TCP/IP in turn can be run over any layer 1 and 2 network protocol.

'Everything over IP', 'IP over Everything':



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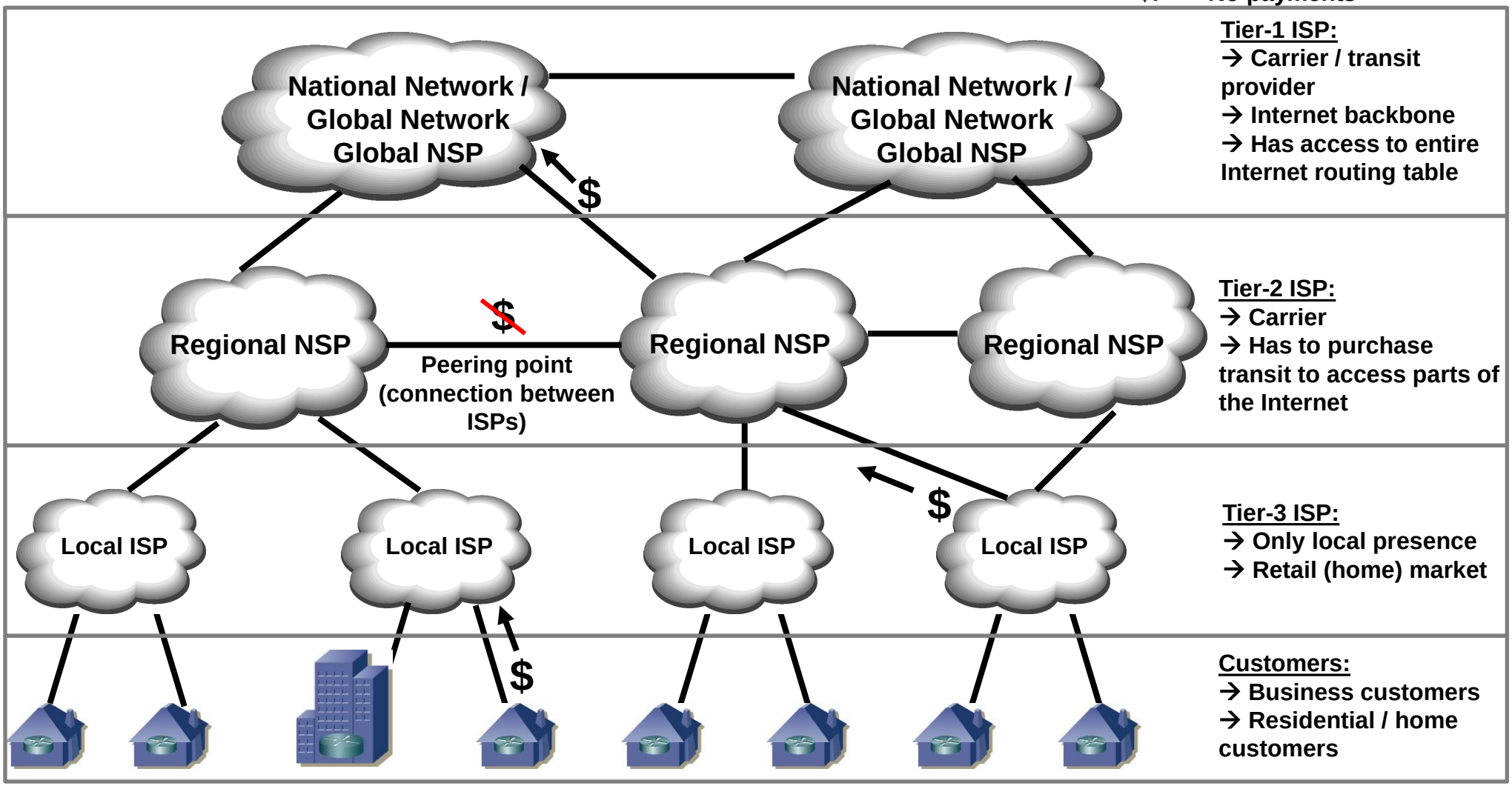
3. Internet Carriers / Providers (1/3)

➔ Three classes of ISPs fulfill different roles in the Internet:

ISP: Internet Service Provider
NSP: Network Service Provider
$: Payments for service
~~$~~: No payments



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3. Internet Carriers / Providers (2/3)

➔ **Provider classification:**

Tier 1 provider:

Tier 1 providers are connected to the Internet backbone and as such are part of the backbone. They sell Internet connectivity and reachability to tier 2 carriers.
Tier 1 carriers usually only peer (connect to) other tier 1 carriers. They do not peer with tier 2 carriers because tier 2 carriers are their customers (definition of peering see below).
Examples: Sprint, Qwest, Global Crossing, AT&T
(see also http://www.interstream.com/resources#transit)

Tier 2 provider:

Tier 2 carriers purchase connectivity to parts of the Internet from Tier 1 carriers.
They connect Tier-3 carriers (ISPs) to the Internet (Tier-1 carriers).
Tier 2 carriers are motivated to peer with other Tier 2 carriers in order to avoid sending traffic through transit providers (tier 1) which costs them money.
Examples: France Telecom, Cogent Communications, Tiscali Int.

Tier 3 provider:

Tier 3 providers have only local presence.
They offer end customers access to the Internet (ISP – Internet Service Provider).
Tier 3 providers have only transit links to tier 2 carriers.
Examples: Local ISPs

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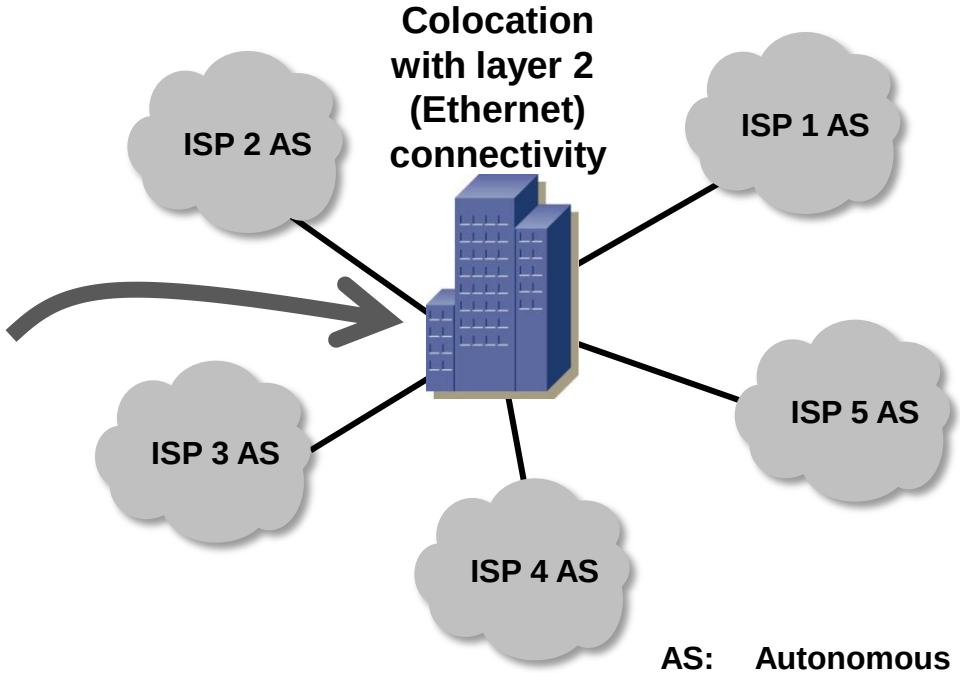
3. Internet Carriers / Providers (3/3)

➔ **Provider peering / Internet exchange:**

→ **Peering means connecting the ASs of ISPs where both carriers / providers have equal rights. Usually the traffic on a peering link is symmetric in both directions so the peering carriers do not charge each other for the traffic.**

→ **Colocation facilities (Internet Exchange Points - IXPs) are locations where ISPs can peer over short physical distances (drawing fibers from one ISP's POP to another IPS's POP over multiple miles is costly).**

Example exchanges: http://www.swissix.ch/, http://www.de-cix.net/



AS: Autonomous System

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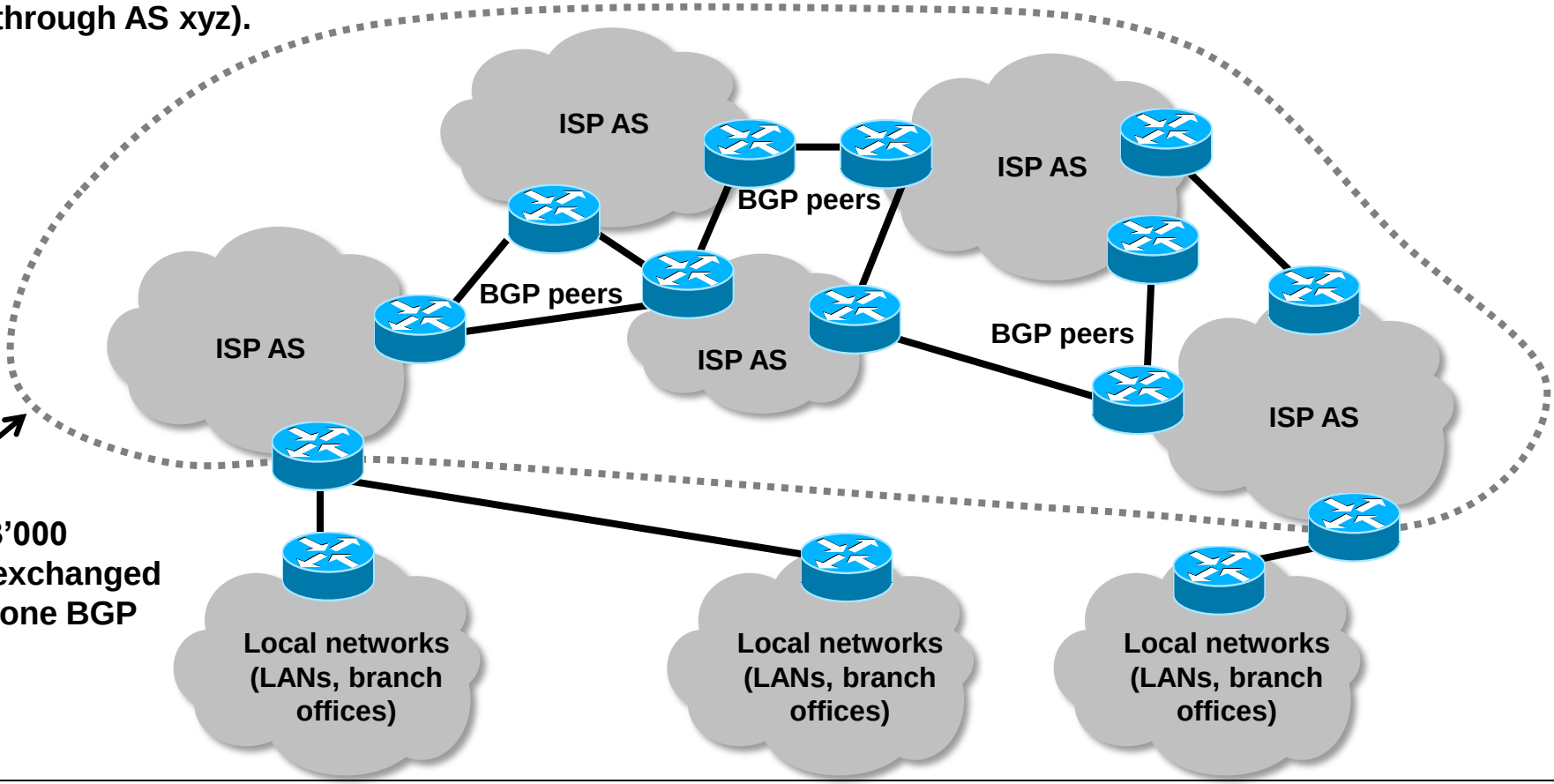
4. Internet Backbone Routing

➔ Non-Internet networks (LANs, branch offices, private networks) run an IGP (Interior Gateway Protocol) such as RIP or OSPF.

➔ IGPs like OSPF or RIP do not scale well to large dimensions (e.g. RIP is limited to 16 hops/routers).

➔ BGP (Border Gateway Protocol) is an EGP (Exterior Gateway Protocol) designed for exchanging route prefixes and route path information between ASs.

➔ BGP is optimized for scalability and allows to route according to policies (eg. a policy could specify not to route traffic through AS xyz).



BGP cloud:
Jan. 2011: ~343'000 route prefixes exchanged between backbone BGP Routers!

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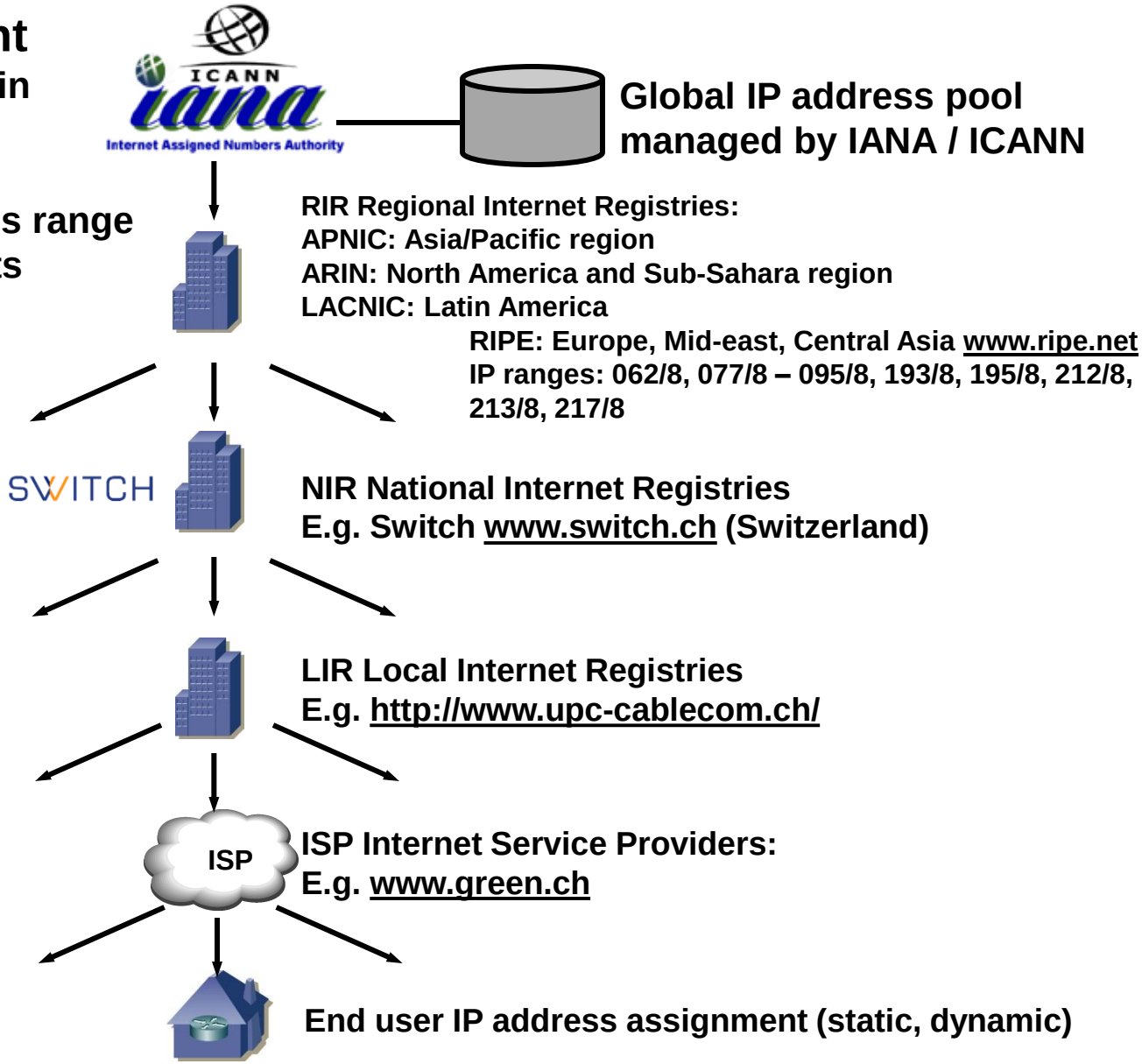
5. IP address assignment

➔ IP addresses are assigned in a delegated manner.

➔ An organization on level X divides its assigned IP address range and assigns portions of it to its subsidiary organizations.



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6. Internet Architectural Principles (1/2)

Several key principles have evolved in the development of the Internet that are pivotal for the stability and scalability of the Internet:

The Internet is decentralized:

There is no central control instance (in theory yes; in practice the Internet is still controlled by the US government).
The Internet is a loosely organized international cooperation of autonomous networks. The different organizations control their network individually. Standards (documented in IETF RFCs) provide the basis for 'gluing' these different networks together.

Route redundancy for resilience:

The Internet has a military background. The distributed topology (mesh) makes the Internet resilient against outages (the network itself establishes alternate paths).

Internet = Inter-Network:

The Internet is an interconnection of multiple physical networks (Internet = “network of networks”).
Inter-Net means that it inter-connects multiple networks (Ethernets, leased lines, wireless etc.).
The common denominator is the protocol IP with inter-network wide addresses (globally unique 32 (IPv4) and 128 (IPv6) bit number).
This is a fundamental difference to e.g. classical voice networks where all 4 or 5 OSI layers are specific to the voice service ('silo').

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6. Internet Architectural Principles (2/2)

Packet switching:

The Internet is based on packet switching (as opposed to circuit switching).
Packet switching makes it easier to inter-connect different networks (no tight timing coupling).
IP routers (called gateways in the 'old Internet days') are used to forward packets towards the destination. Packet switching yields better performance as it can exploit statistical multiplexing.

Best effort service:

The forwarding process of the routers is best-effort, i.e. they do not perform retransmissions, error control etc.. All these functions are the job of software in the end-systems.

Intelligence resides in end-systems:

Even though Internet backbone routers are very complex machines these days, a key principle is the demarcation between the ('dumb') network that merely forwards packets and the ('smart') application that does all the business logic (plus transport functions like flow / error control).

The Internet is not free (free as in 'free beer'):

The Internet is not free (initially it was), there is a business case. People pay ISPs (Network Service Provider) money so that these give an IP address and forward their packets. ISPs in turn pay money to transit providers for connectivity and packet forwarding.

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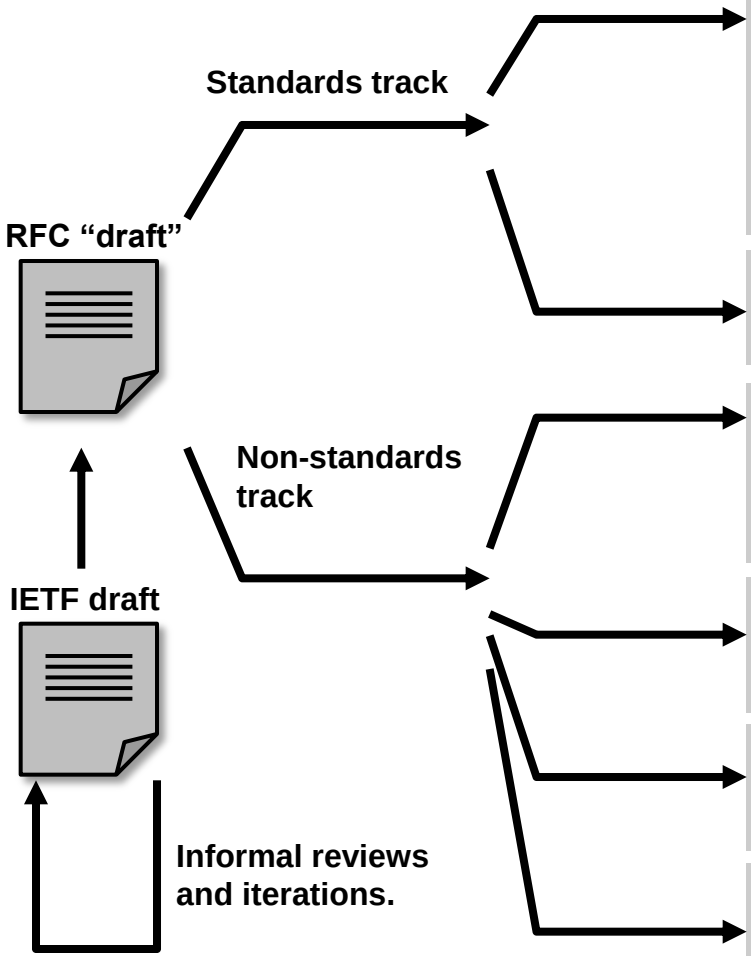
7. Internet Standardization Process (RFC2026 et. al.)

1. A draft has to be submitted to an RFC editor.
2. A draft has to adhere to some basic principles and formatting.
3. A draft may take different paths:



***RFC** track (intended to become a standard):*
Internet standards proposed by anyone.
Subject to peer reviews and approval by IESG.
2 Maturity levels:
1. Proposed standard
2. Internet standard **STD** (requires 2 independent and interoperable implementations)

RFCxxxx
STDxxxx
Category: STD

Best Current Practice BCP:
Technical information published by IETF itself.
Approved by IESG.

RFCxxxx
BCPxxxx
Category: BCP

Experimental (for experimental purposes):
Specification is part of research and development effort.
Published as an archival record.
Approved by RFC editor alone (consults IESG).

RFCxxxx
Category: Experimental

Informational:
Does not represent a recommendation.
Approved by RFC editor alone (consults IESG).

RFCxxxx
Category: Informational

For Your Information FYI:
Same as Informational, but own sub-series.
(Not used anymore)

RFCxxxx
FYIxxxx
Category: FYI

Historical:
Any RFC superseded by a newer RFC becomes historic.

RFCxxxx
Category: Historic

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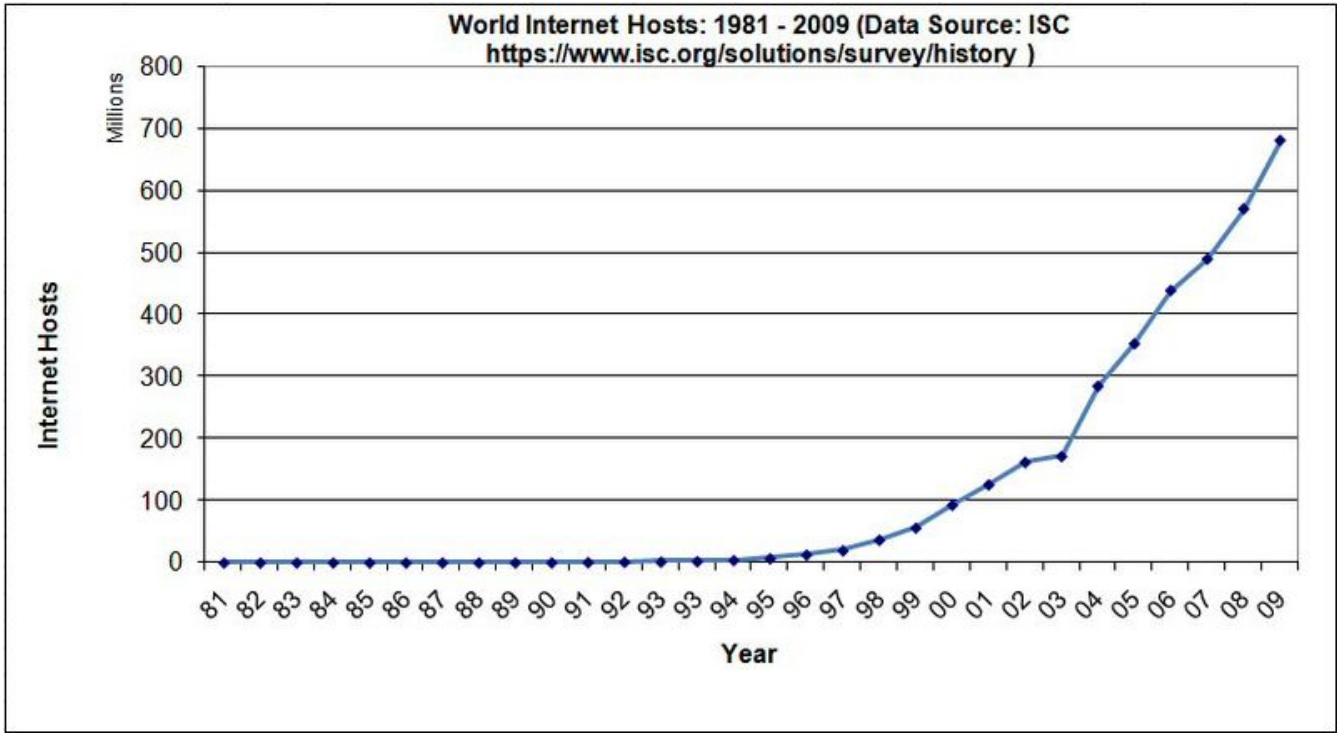
8. Internet by figures

Some useful links with Internet statistical data

https://secure1.securityspace.com/s_survey/data/
http://www.dnswatch.info/
http://www.internetworldstats.com/
http://www.zakon.org/robert/internet/timeline/



Source: http://en.wikipedia.org/wiki/History_of_the_Internet

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