

IP addressing

Hank Nussbacher

Petach Tikve
December 2019

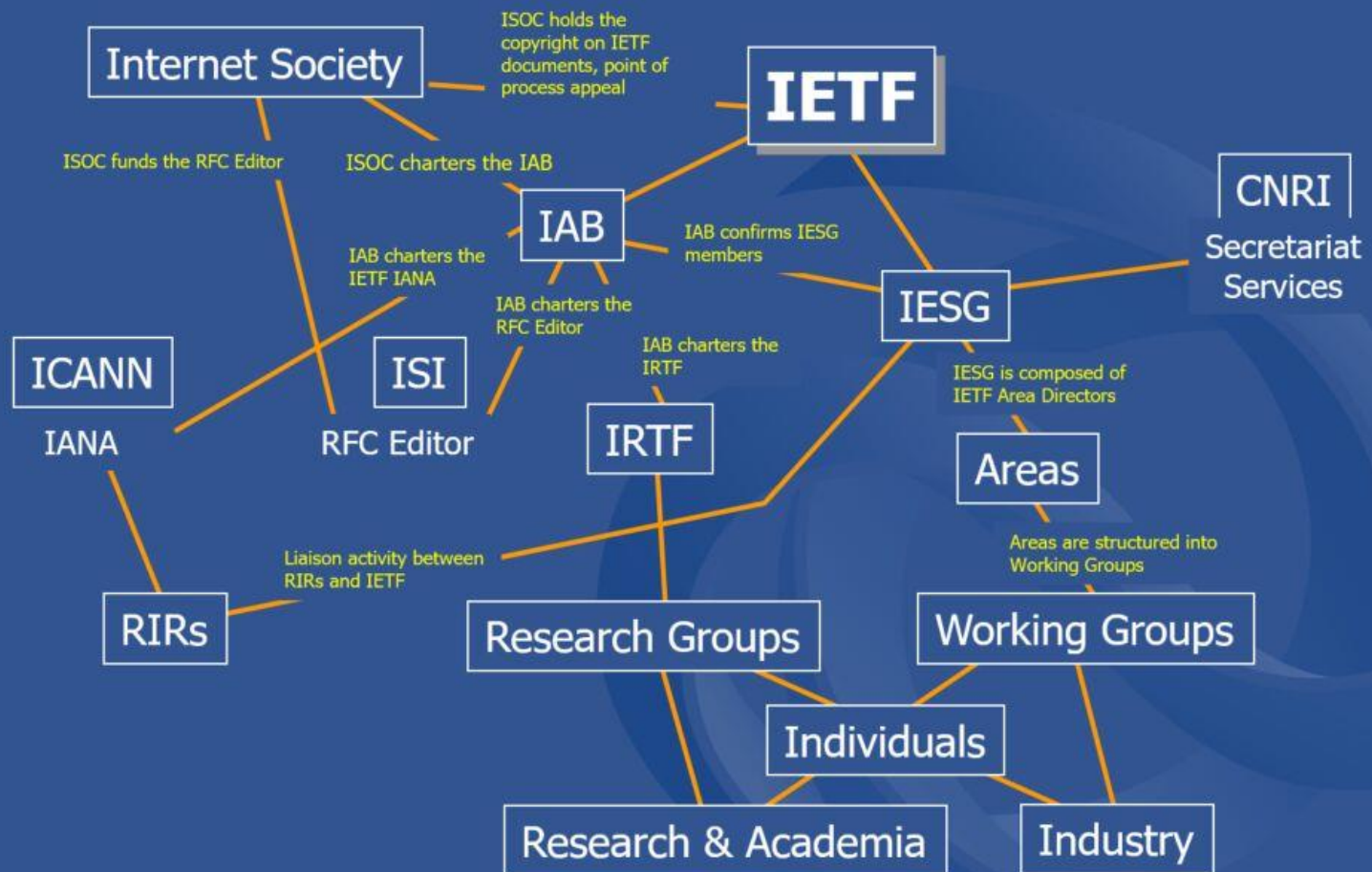


IP Background

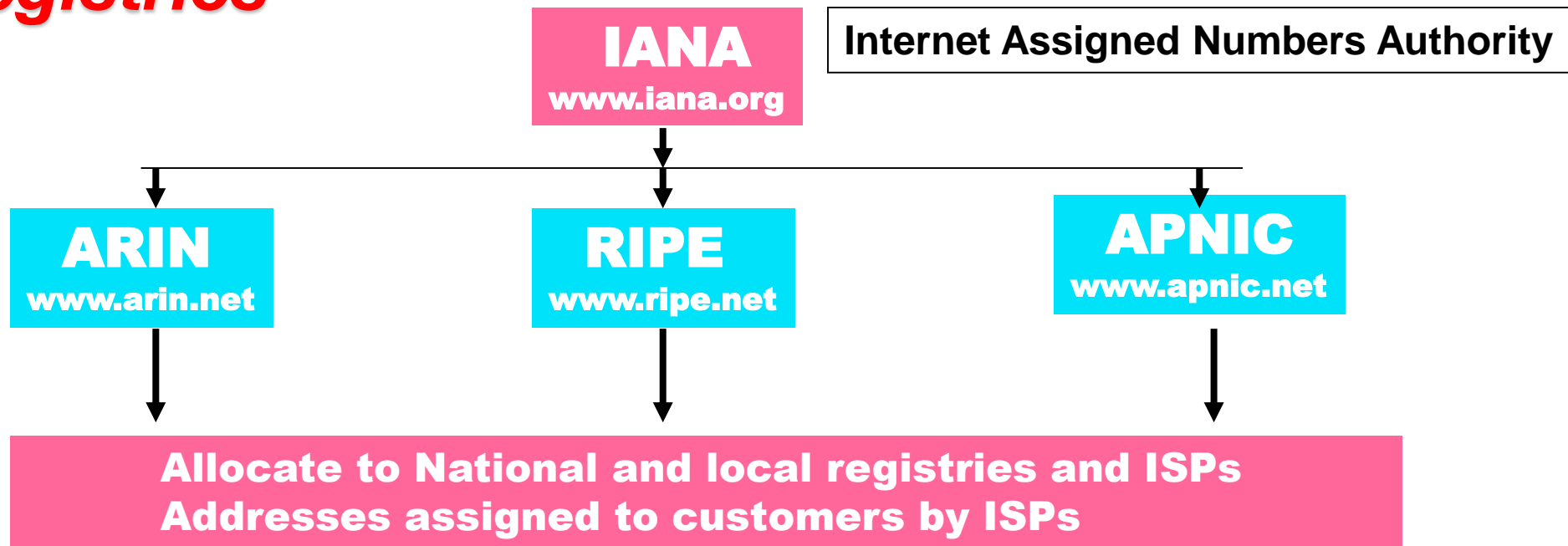
- Cooperation between ISPs
- IAB: Internet Architecture Board
- IETF: Internet Engineering Task Force
- All volunteerism
- Rough consensus and running code
 - “We reject kings, presidents and voting; we believe in rough consensus and running code”



IETF Roles and Relationships



IP Address Allocation and Assignment: Internet Registries



RFC 2050 - Internet Registry IP Allocation Guidelines
RFC 1918 - Address Allocation for Private Internets
RFC 1518 - An Architecture for IP Address Allocation with CIDR

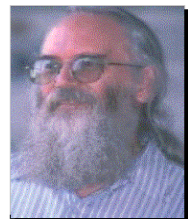


The early years: 1981 – 1992

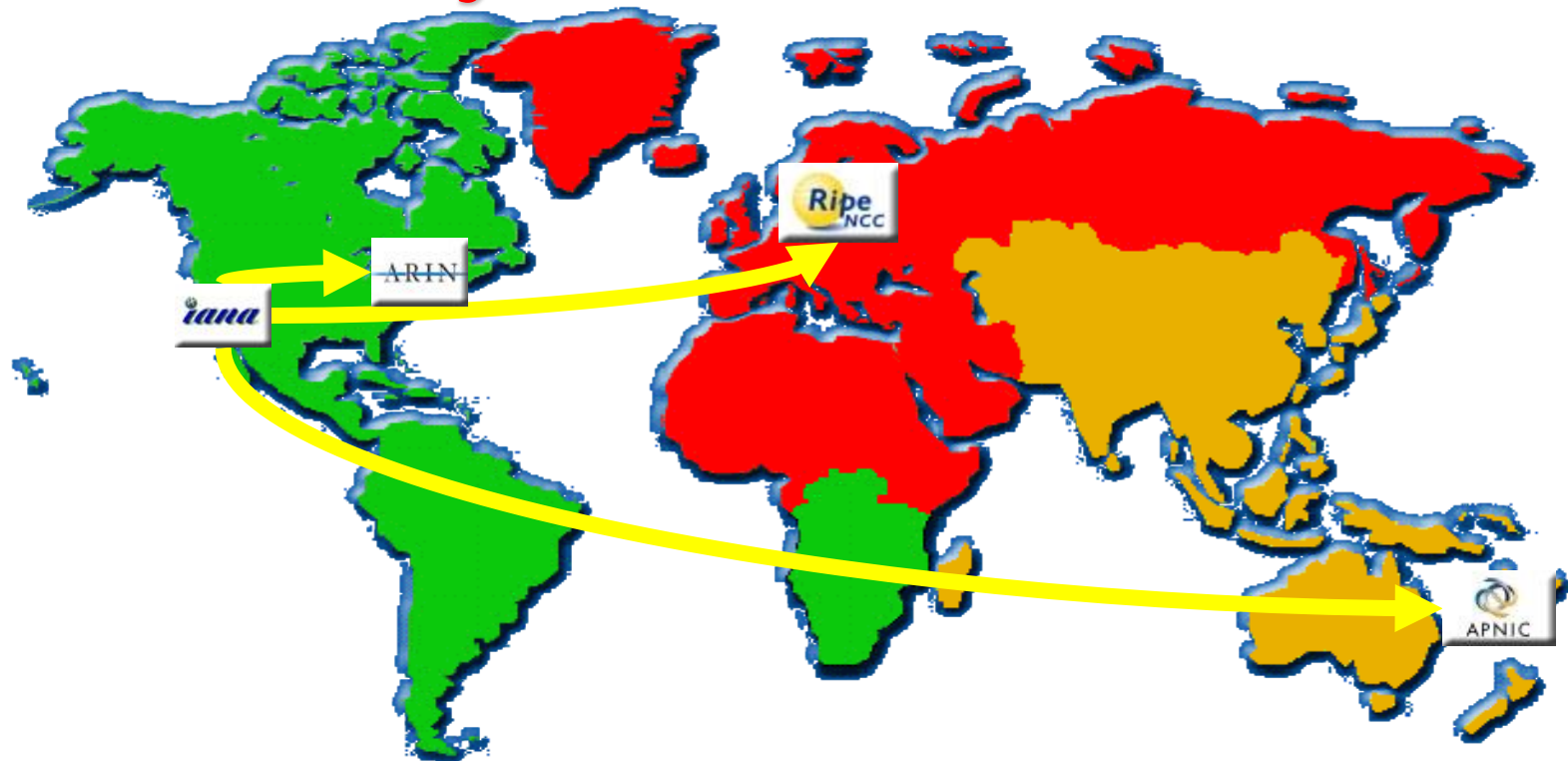


1981:

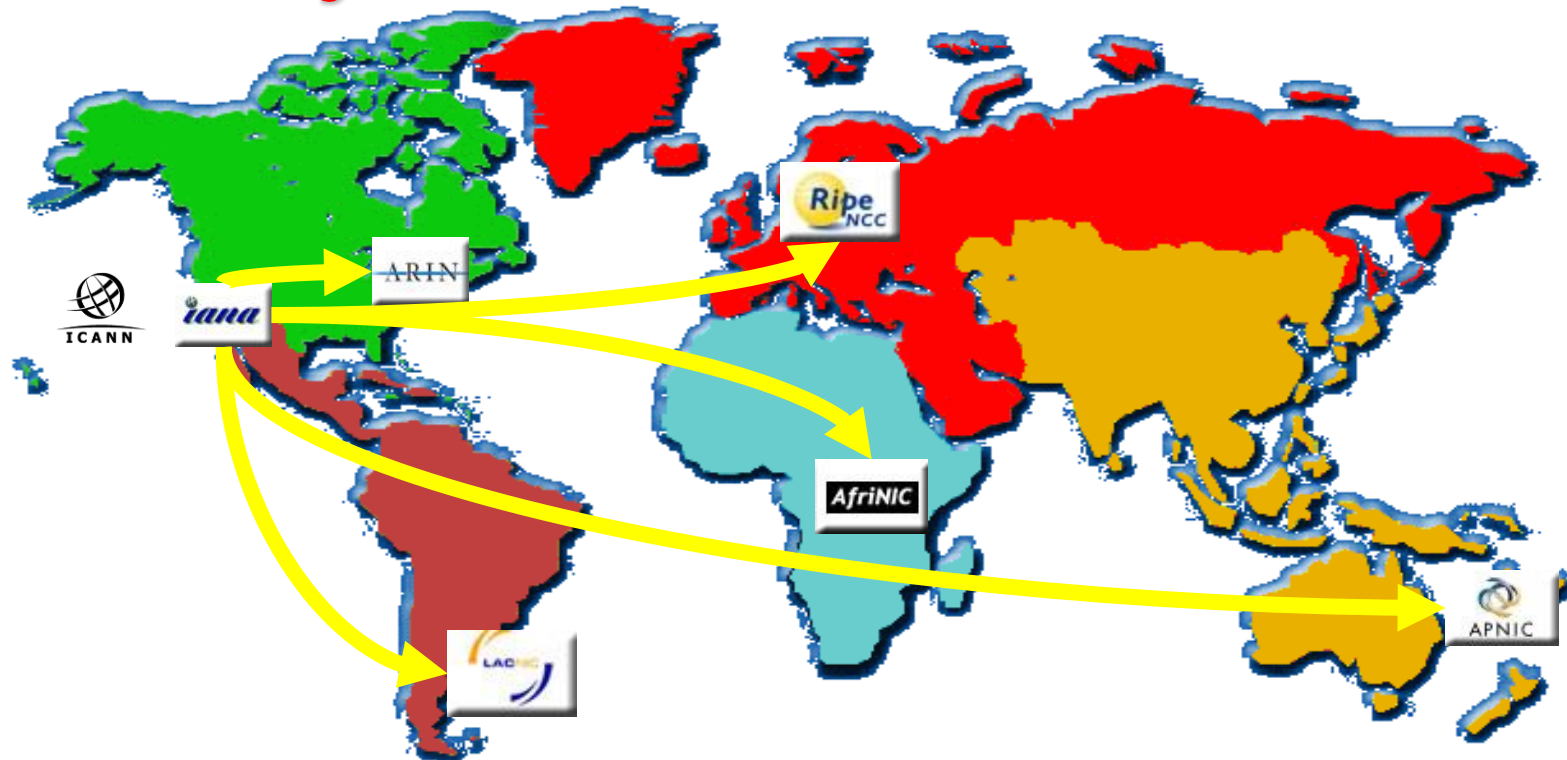
“The assignment of numbers is also handled by Jon. If you are developing a protocol or application that will require the use of a link, socket, port, protocol, or network number please contact Jon to receive a number assignment.” (RFC 790)



The boom years: 1992 – 2001



Recent years: 2002 – 2019



What are RIRs?

- Service organisations
- Representative of ISPs globally
 - Industry self-regulatory structures
 - Non-profit, neutral and independent
 - Open membership-based bodies
- First established in early 1990's
 - Voluntarily by consensus of community
 - To satisfy emerging technical/admin needs
- In the “Internet Tradition”
 - Consensus-based, open and transparent



What do RIRs do?

- **Internet resource allocation**
 - Primarily, IP addresses – IPv4 and IPv6
 - Receive resources from IANA/ICANN, and redistribute to ISPs on a regional basis
 - Registration services (“whois”)
- **Policy development and coordination**
 - Open Policy Meetings and processes
- **Training and outreach**
 - Training courses, seminars, conferences...
 - Liaison: IETF and ITU



How do RIRs do it?

- Open and transparent processes
 - Decision-making
 - Policy development
- Open participation
 - Democratic, bottom-up processes
- Membership structure
 - 100% Self-funded through membership fees



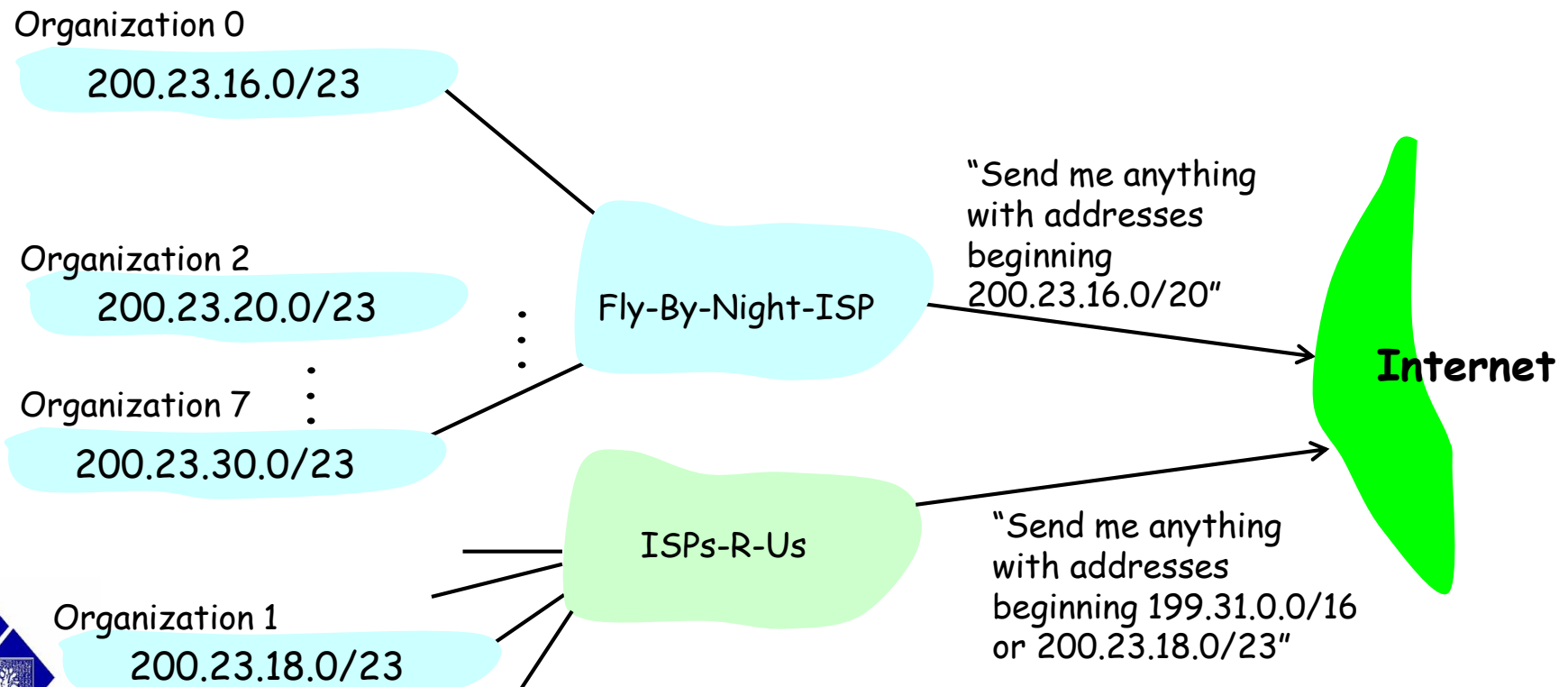
IP addressing

- all IP addresses are 32 bits long
- 1.0.0.0 - 223.255.255.255
- 0.0.0.0 and 255.255.255.255 and 224.0.0.0-255.255.255.255 have special uses
- A range of IP addresses is represented as follows
 - /23 – 128 IP addresses
 - /24 – 256 IP addresses
 - /16 – 65536 IP addresses



Hierarchical addressing: more specific routes

ISPs-R-Us has a more specific route to Organization 1



138.134.0.0/16

- Block of 65536 IP addresses I assigned to the Israeli Electric Company in 1992
- In 2015, RIPE sets out to “normalize” all legacy IP addresses that were assigned to organizations before there was proper vetting and checking
- “We also need a copy of the company registration papers from Israel Electric Company”



GOVERNMENT OF PALESTINE

Certificate of the Incorporation of a Company.

I hereby certify that

the Palestine Electric Corporation Limited

was incorporated under the Companies Ordinance 1921 as a Limited Company

on the Twenty ninth day of March

One thousand ~~nine hundred~~ & twenty three

Given under my hand at Jerusalem this thirty first ✓

day of March One thousand ~~nine hundred~~ & twenty three

M. M. M. M.
Registrar of
Companies & Partnerships.



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الشركة الفلسطينية للكهرباء
PALESTINE ELECTRIC COMPANY P.L.C

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Annual Report 2018 (new)

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إننا ماضون في تحقيق مزيداً من النمو والنجاح للحفاظ
على مقدرات الشركة وحماية حقوق مساهميها
(وليد سلمان نائب رئيس مجلس الإدارة / المدير التنفيذي العام)

0:00 / 2:00

YouTube





פקודת החברות

תעודת שינוי שם

הנני מאשר בזה כי על סמך החליטה כיווחדת ובהתאם לסעיף 25 של פקודת החברות שינתה החברה:

THE PALESTINE ELECTRIC CORPORATION LIMITED


את שמה, ומעתה תקרא בשם:

חברת החשמל לישראל בע"מ מוגבל

THE ISRAEL ELECTRIC CORPORATION LIMITED

והשם המתוקן כגיל נרשם במגנס החברות.

תשכ"א	שנה	ניסן	בחודש	כה	ניתן בחתימת ידי בירושלים היום הזה
1961		אפריל		11	



רשם החברות

מס' חברה 52-000047-2



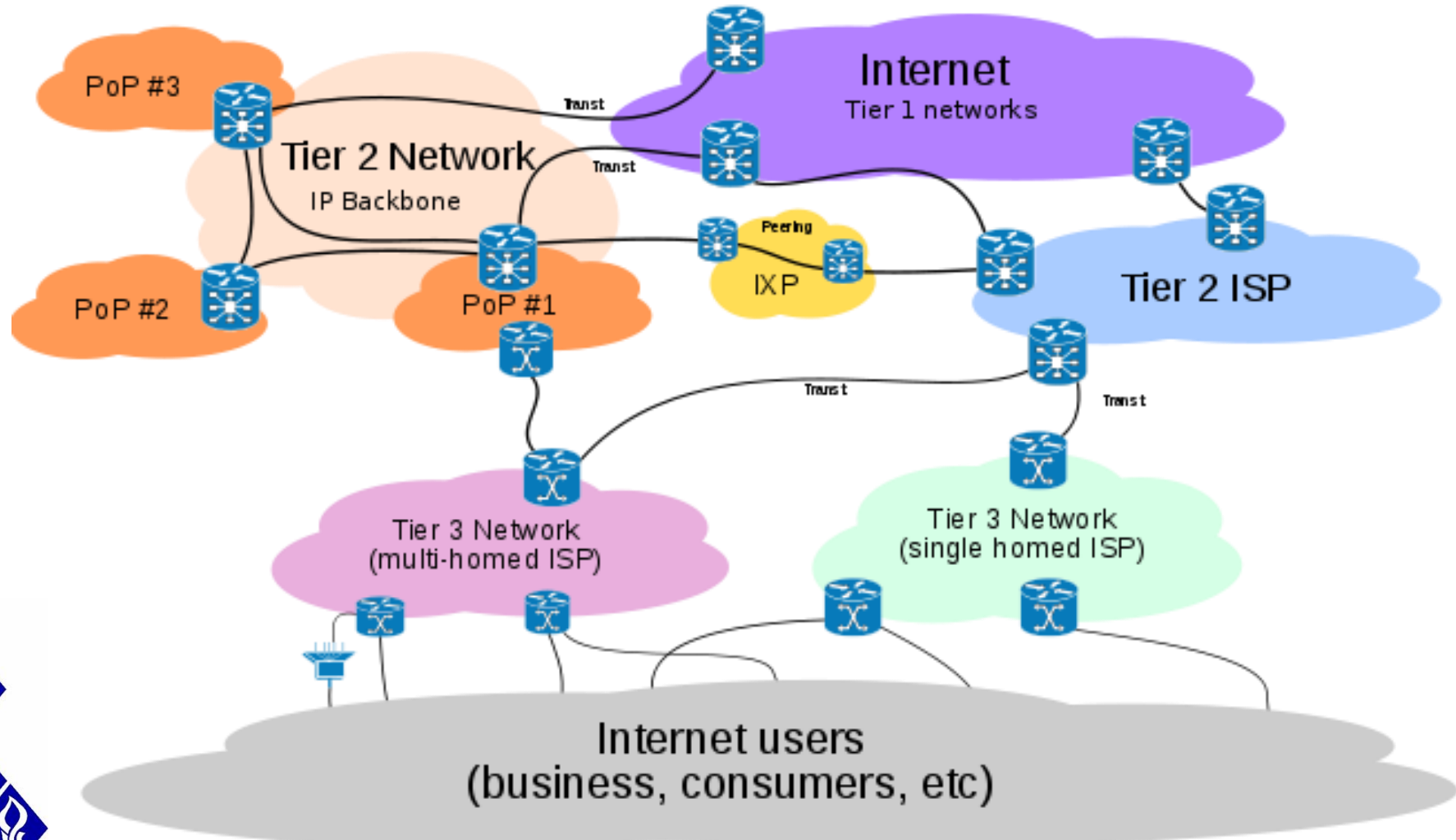
ממשל זמין

מנהלת הרשת הממשלתית
בקשה לקבלת הצעות
להקמה ותפעול של רשת תקשורת ממשלתית
תאריך הדפסה: 03/05/99

משרד	מרחב כתובות פרטיות	מרחב כתובות ציבוריות	Autonomous System Number
משרד האוצר	10.5.xxx.yyy 172.16.xxx.yyy 192.168.0-4.yyy	147.237.224.yyy	64512
משרד לתשתיות לאומיות	10.12.xxx.yyy 192.168.5-8.yyy	147.237.226.yyy	64513
משרד הבטחון	10.15.xxx.yyy 172.17.xxx.yyy 192.168.9-12.yyy	147.237.228.yyy	64514
משרד הבריאות	10.24.xxx.yyy 172.18.xxx.yyy 192.168.13-16.yyy	147.237.80.yyy	64515
משרד הדתות	10.22.xxx.yyy 192.168.17-20.yyy	147.237.230.yyy	64516
משרד החוץ	10.9.xxx.yyy 192.168.21-24.yyy	147.237.208.yyy	64517
משרד החינוך	10.20.xxx.yyy 172.19.xxx.yyy 192.168.25-28.yyy	147.237.176.yyy	64518
משרד החקלאות	10.33.xxx.yyy 172.20.xxx.yyy 192.168.29-32.yyy	147.237.96.yyy	64519
משרד המדע	10.52.xxx.yyy 192.168.33-36.yyy	147.237.232.yyy	64520
משרד המשפטים	10.8.xxx.yyy 172.21.xxx.yyy 192.168.37-40.yyy	147.237.134.yyy	64521
משרד העבודה והרווחה	10.23.xxx.yyy 172.22.xxx.yyy 192.168.41-44.yyy	147.237.112.yyy	64522
משרד הפנים	10.6.xxx.yyy 172.23.xxx.yyy 192.168.45-48.yyy	147.237.128.yyy	64523
משרד הקליטה	10.30.xxx.yyy	147.237.136.yyy	64524



Internet exchanges



The largest ISPs in the world

AS rank	AS number	organization	customer cone						ASN degree
			number of			percentages of all			
			ASNs	addresses	prefixes	ASNs	addresses	prefixes	
1	3356	Level 3 Communications, Inc.	31276	810952192	224366	51.77%	28.31%	28.87%	4962
2	1299	Telia Company AB	26936	849693952	251952	44.59%	29.66%	32.42%	1655
3	174	Cogent Communications	23492	778813952	187665	38.89%	27.18%	24.15%	5323
4	3257	GTT Communications Inc.	21838	596092416	208339	36.15%	20.81%	26.81%	1573
5	2914	NTT America, Inc.	18356	660040192	188554	30.39%	23.04%	24.26%	1683
6	6762	TELECOM ITALIA SPARKLE S.p.A.	15254	300670208	126007	25.25%	10.49%	16.21%	437
7	6453	TATA COMMUNICATIONS (AMERI...	14892	593705472	172649	24.65%	20.72%	22.22%	725
8	6939	Hurricane Electric, Inc.	10397	309512704	100003	17.21%	10.8%	12.87%	6844
9	3549	Level 3 Communications, Inc.	6483	55296512	42768	10.73%	1.93%	5.5%	2559
10	1273	Vodafone Group PLC	6347	173088000	52382	10.51%	6.04%	6.74%	320
11	3491	Beyond The Network America, Inc.	6319	124672512	70152	10.46%	4.35%	9.03%	625
12	209	Qwest Communications Company...	4797	258437888	47347	7.94%	9.02%	6.09%	1885
13	6461	Zayo Bandwidth	4785	107404544	32734	7.92%	3.75%	4.21%	1708
14	9002	RETN Limited	4613	26049792	22782	7.64%	0.91%	2.93%	1370
15	12956	Telefonica International Wholesale...	4244	123264000	35436	7.03%	4.3%	4.56%	305

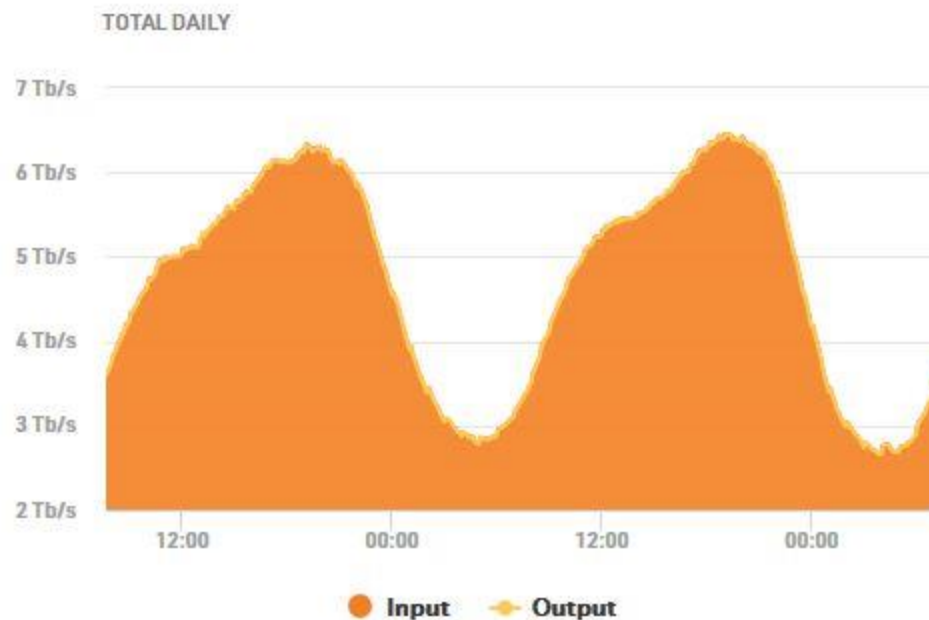


The Largest IXPs

Short name	Name	City	Country	Established	Members	Throughput (Gbit/s) maximum	Throughput (Gbit/s) average	Values updated
DE-CIX	Deutsche Commercial Internet Exchange ^[1]	Frankfurt, Hamburg, Munich, Düsseldorf, New York City, Dubai (As UAE-IX), Palermo, Marseille, Istanbul, Dallas, Madrid	Germany, USA, UAE, Italy, France, Turkey, Spain	1995	735 ^[2]	6125 ^[3]	3914 ^[3]	13 December 2017
AMS-IX	Amsterdam Internet Exchange ^[4]	Amsterdam ^[5] , Haarlem ^[6] , Schiphol-Rijk ^[5] , Willemstad ^[6] , Hong Kong ^[7] , New York City ^[8] , Chicago ^[9] , San Francisco Bay Area ^[10] , Mumbai ^[11]	Netherlands, Curaçao, China, USA, India	1997 ^[12]	818 ^[13]	5513 ^[14]	3339 ^[14]	13 December 2017
IX.br	Brazil Internet Exchange ^[15]	Belém, Belo Horizonte, Brasília, Campina Grande, Campinas, Caxias do Sul, Cuiabá, Curitiba, Florianópolis, Fortaleza, Goiânia, Lajeado, Londrina, Manaus, Maringá, Natal, Porto Alegre, Recife, Rio de Janeiro, Salvador, São Carlos, São José dos Campos, São José do Rio Preto, São Paulo, Vitória	Brazil	2004	1350 ^[16]	4020 ^[17]	2630 ^[17]	19 January 2018
LINX	London Internet Exchange ^[18]	London, Manchester, Edinburgh, Cardiff, Northern Virginia ^[19]	United Kingdom, USA	1994	789 ^[20]	3860 ^[21]	2455 ^[21]	7 November 2017
MSK-IX	MSK-IX ^[22]	Moscow, Saint-Petersburg, Novosibirsk, Rostov-on-Don, Stavropol, Samara, Kazan, Ekaterinburg, Vladivostok	Russia	1995	504 ^[23]	2821 ^[24]	1211 ^[24]	25 February 2017
DATA-IX	DATA-IX ^[25]	Moscow, Saint-Petersburg, Novosibirsk, Samara, Ufa, Perm, Ekaterinburg, Chelyabinsk, Krasnoyarsk, Khabarovsk, Omsk	Russia, Ukraine, Kazakhstan, Germany	2009	344 ^[26]	2700 ^[27]	1300 ^[28]	5 February 2017
NL-ix	Neutral Internet Exchange ^[29]	Various cities ^[30]	Austria, Belgium, Czech Republic, Denmark, France, Germany, Italy, Luxembourg, Netherlands, Poland, Sweden, Switzerland, United Kingdom ^[31]	2002 ^[32]	600 ^[33]	1770 ^[34]	979 ^[34]	19 October 2016
Equinix	Equinix Exchange ^[35]	Paris, Zürich, New York (Secaucus, NJ and New York City), Washington, DC (Ashburn, VA), Washington, DC (Vienna, VA), Chicago, Dallas, Los Angeles, Silicon Valley (Palo Alto, CA), Silicon Valley (San Jose, CA), Tokyo, Hong Kong, Singapore, Sydney, Rio de Janeiro, São Paulo	USA, Europe, Japan, Singapore, Hong Kong, Australia, Brazil	1998	768 ^[36]	1600 ^[37]	990 ^[37]	25 March 2016
W-IX	W-IX LTD	Moscow, Saint-Petersburg, Frankfurt, London, Amsterdam, Omsk, Perm, Chelyabinsk, Kiev, Voronezh, Samara, Cheboksary, Kazan, Novosibirsk, Tyumen, Ekaterinburg, Vladimir, Ufa	Russia, Europe, Ukraine	2008	166 ^[38]	1500 ^[39]	810 ^[39]	5 February 2017



AMS-IX stats



PEAK IN	PEAK OUT
6.455 Tb/s	6.448 Tb/s

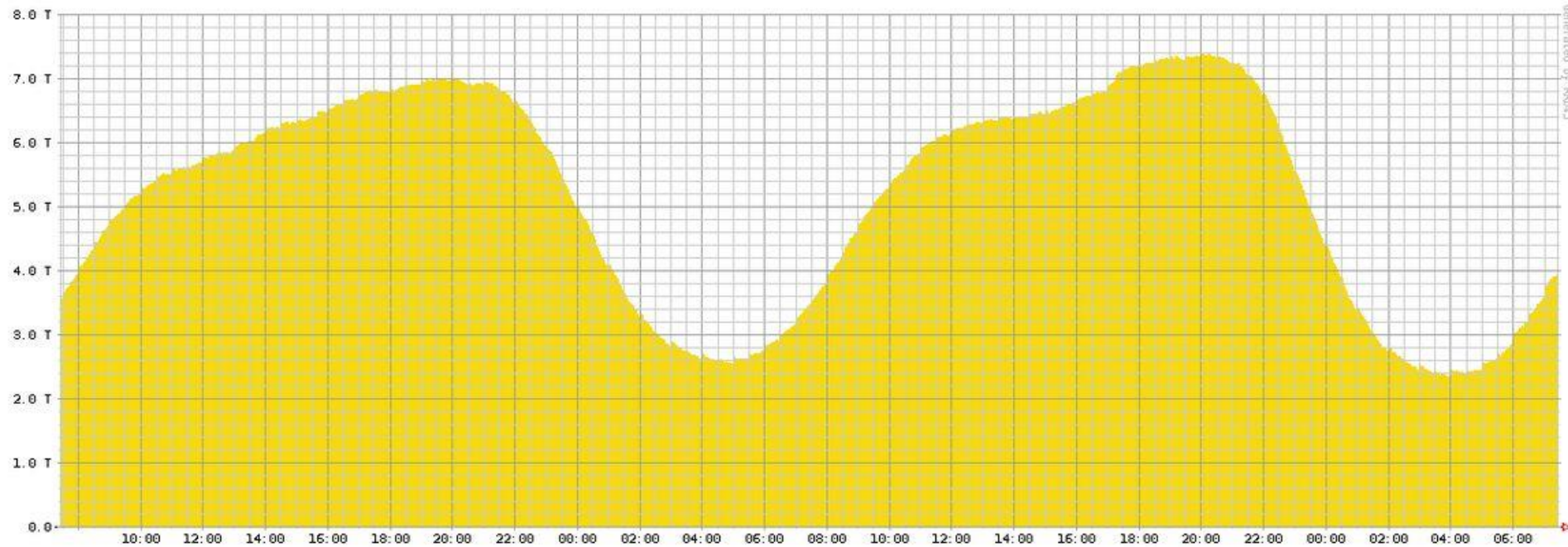
AVERAGE IN	AVERAGE OUT
4.714 Tb/s	4.713 Tb/s

CURRENT IN	CURRENT OUT
3.678 Tb/s	3.675 Tb/s



DE-CIX stats

2-day graph





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German NSA has deal to tap ISPs at major Internet Exchange

Spy agency BND stays mum on how it's distinguishing domestic vs. foreign traffic.

by **Cyrus Farivar** - Oct 7, 2013 9:12pm EEST



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The rough German equivalent of the National Security Agency has secret arrangements with local telecom firms, providing direct access to data flowing over domestic fiber. According to the German magazine *Der Spiegel* (Google Translate), the Federal Intelligence Service (known by its German acronym, **BND**) has taps on the major Internet exchange point in Frankfurt known as **DE-CIX**.

On Sunday, the magazine cited a "three-page confidential letter" that was signed by Chancellor Angela Merkel's office and the Ministry of the Interior. The letter noted that the BND would also have access to data sent over 25 major German ISPs, including 1&1, Freenet, Strato, GSC, and Lambdanet Plus. The letter was sent to **ECO**, the German Internet business trade group, and the magazine did not specify how it obtained this letter.

Neither DE-CIX nor ECO immediately responded to Ars' request for comment.



LATEST



Largest Internet Exchange Point Announces Complaint Against Snooping

24/04/2015 BY MONIKA ERMERT FOR INTELLECTUAL PROPERTY WATCH — 4 COMMENTS



MUNICH – Decix, the largest internet traffic exchange point (IXP) worldwide, has had it with the snoops. Today (23 April), the Frankfurt company confirmed a report by the Sueddeutsche Zeitung that it will file a complaint at the German Federal Administrative Court against the obligation to grant broad access to the German Intelligence Service (BND) to the traffic transiting its large switches. Decix management thinks the constitutionality of the activities is highly questionable and the G10 legislation (allowing for preventive surveillance under certain conditions) is not adapted to an international IP communication network. New revelations today that the US National Security Administration (NSA) used the data collected by the BND to spy on politicians and companies in Germany and the EU companies like EADS, Eurocopter and French authorities fired the renewed debate in Berlin.

