



# IPv6-Based



# Internet Generations

**ArpaNET**

**InterNET**  
**InterNAT**

**New InterNET**

**NCP**  $2^8$

**IPv4/NAT**  $2^{32}$

**IPv6**  $2^{128}$

Pioneers

Innovators  
NAT engineers

EveryOne  
Everything

Email, FTP

WWW- Client/Server

Wireless, Streaming  
Media, P2P, GRID

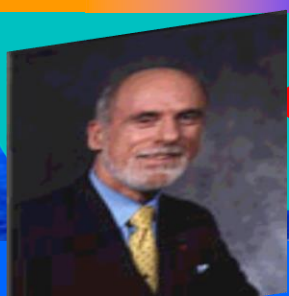
**TOURISTS**

**RESIDENTS**

Gov. Internet

ic Int

Global Internet



From **InterNET** to **InterNAT**

From

**NET**work of **NET**works

to

**NAT**work of **NAT**works

**InterNAT** of Things

# WEB Generations

WEB 1.0

WEB 2.0

WEB 3.0

W o T

IPv4

IPv4/NAT

IPv6

HTTP

HTML

XHTML

WoT

WWW

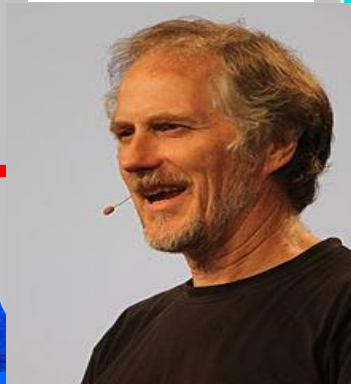
Interactive

Semantic Web

Tim Berners-Lee

Tim O'Reilly

Dave Raggett



W3C



# Wireless Generations



Analogue	GSM	WCDMA	OFDM	MIMO/ mmWAVE
Voice	Digital V	WAP	IMS	IOT?
Surprise: Eaves- Fax & dropping Modem	SMS	WEB	Youtube	VERTICALS



Vision 2020

# IoT Generations

**IoT 1**

**IoT 2**

**IoT 3**

**Non-IP**

**IPv4/NAT**

**IPv6**

**IP**

**Technology**

**RFID/KNX  
BackNet**

**One-Way  
Gateways**

**Two-Way  
Things-2-Things**

**Media**

**Network  
of Things**

**IoT  
devices**

**IPv6 Sensors  
...**

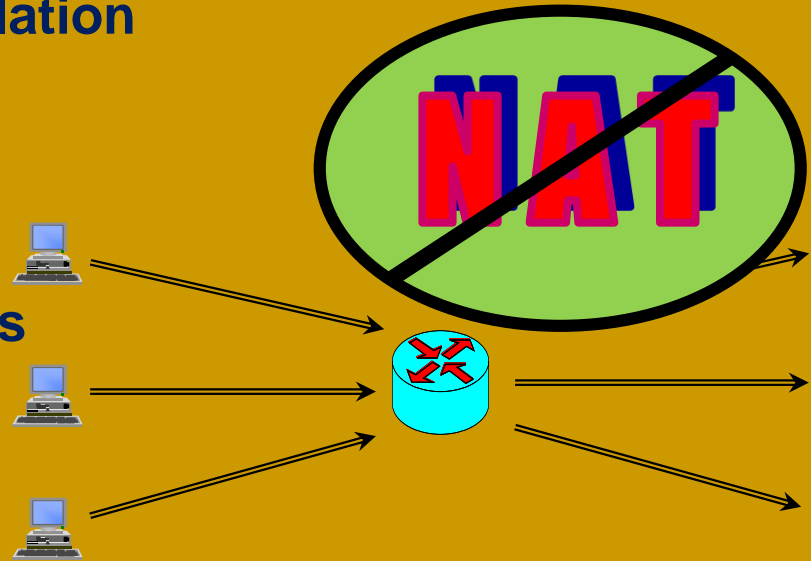
**Kevin Ashton**



**Global IoT Internet**

# Major Problem is NAT

- Overhead of unnecessary translation
- Protocol incompatibilities
  - IPsec,...
- Breaks peer-to-peer applications
  - Instant messaging
  - Interactive games
  - VoIP
  - Real-time collaboration and sharing
    - Netmeeting, BitTorrent, Groove
- Limits implementation of application servers
  - How far can you distribute your web-services?
  - Grid computing



**Building work-arounds for everything NAT breaks is an unnecessary and inefficient effort!**

# Success Challenges: Kevin Ashton



**ADDRESSES**  
**LOW POWER**  
**SENSOR DATA FORMATS**  
**PHYSICAL MARKUP LANGUAGE**  
**MACHINE LEARNING INTERCHANGE**  
**LOSSLESS COMPLEX SIGNAL COMPRESSION**  
**STREAMING DATA FOR FEEDBACK SYSTEMS**

**Use IPv6**

**Harvesting Power**  
**Wireless Power**

**Open data formats**

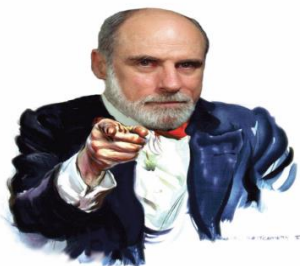
**CoAP**

**Autonomicity**

**standardisation**

**Sensor QoS**





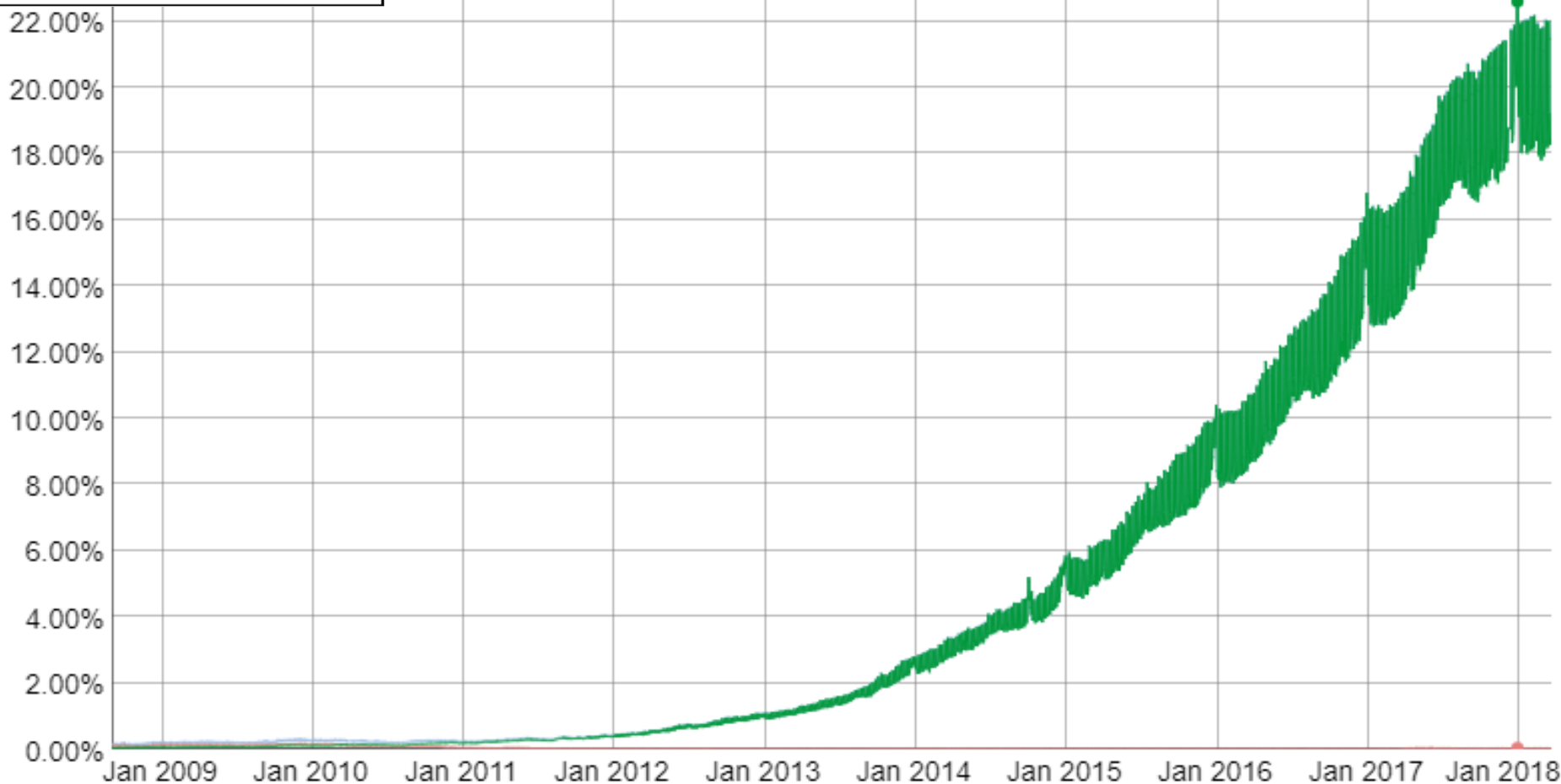
**I WANT YOU  
TO USE IPv6**

— VINT CERF

# Crossed 20% Google v6 Users 2017

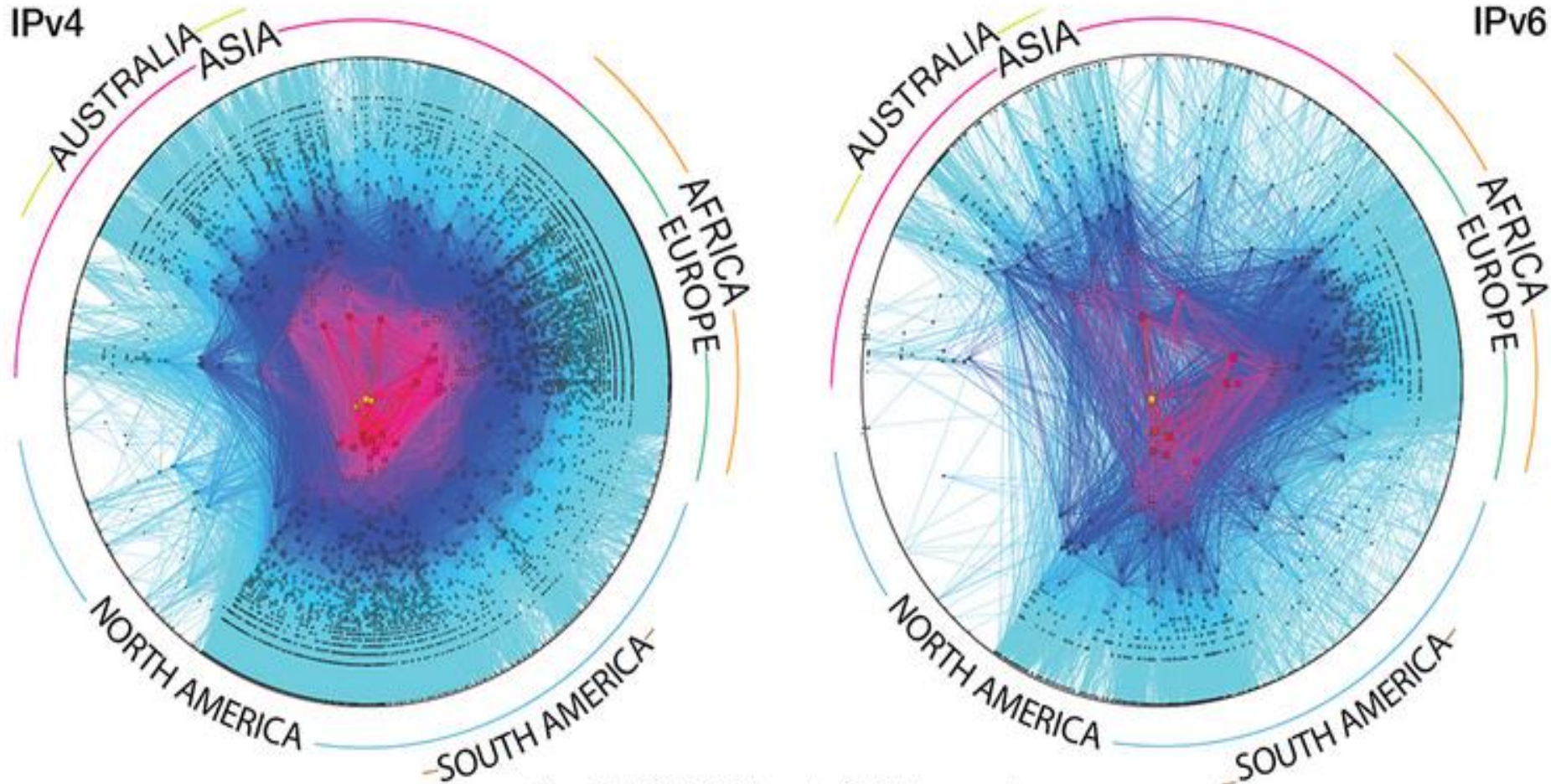


Native: 22.60% 6to4/Teredo: 0.04% Total IPv6: 22.64% | Dec 31, 2017



# Visualizing IPv4 and IPv6 Internet Topology

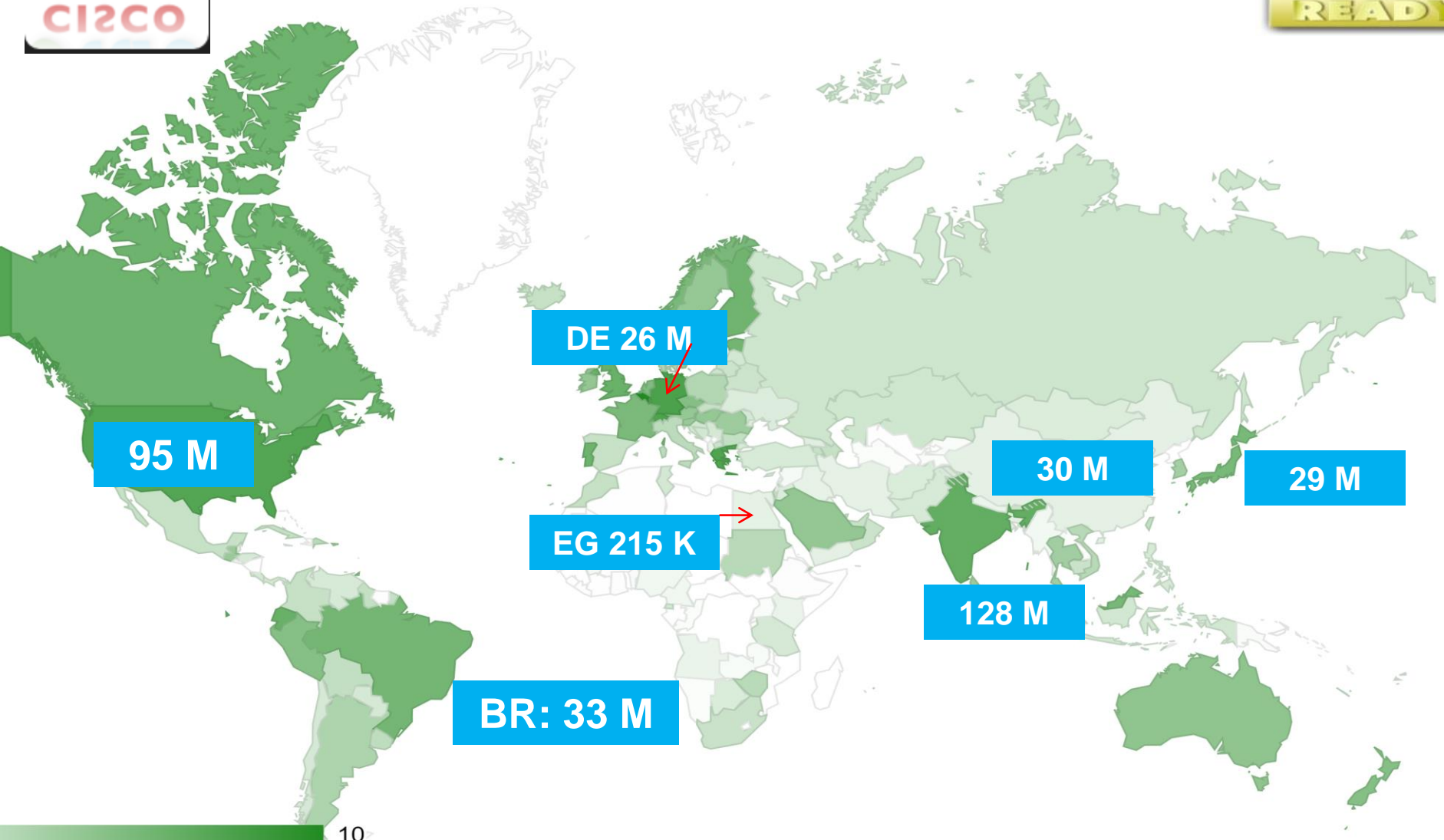
CAIDA's IPv4 & IPv6 AS Core  
AS-level INTERNET Graph  
*Archipelago January 2014*



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# IPv6 Deployment Worldwide



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# IPv6 Deployment Worldwide



Date: 25 Mar 2018

Index	ISO-3166 Code	Internet Users	V6 Use ratio	V6 Users (Est)	Population	Country
1	BE	10176188	57.81	5883058	11498518	Belgium
2	IN	471210045	50.84	239581005	1354051854	India
3	DE	72418242	42.30	30632250	82293457	Germany
4	US	289188571	40.06	115854131	326766748	United States of America
5	GR	7220120	36.89	2663339	11142161	Greece
6	CH	7450397	34.48	2568967	8544034	Switzerland
7	LU	561985	33.15	186293	590321	Luxembourg
8	UY	2255208	32.41	730876	3469551	Uruguay
9	GB	61647064	26.06	16067343	66573504	United Kingdom of Great Britain
10	PT	6925974	25.01	1731872	10291196	Portugal
11	JP	115865837	24.29	28138219	127185332	Japan
12	MY	21981126	20.93	4601070	32042458	Malaysia
13	BR	140016321	20.90	29257550	210867954	Brazil
14	FR	56361545	20.84	11747224	65233270	France
15	TT	948465	20.49	194340	1372598	Trinidad and Tobago
16	CA	32704082	20.08	6566459	36953765	Canada
17	EE	1194404	17.69	211259	1306788	Estonia
18	FI	5126828	17.66	905149	5542517	Finland
19	PE	13346244	17.53	2339163	32551815	Peru
20	IE	3891035	16.82	654537	4803748	Ireland





## Visible ASNs: Customer Populations (Est.)

Rank	ASN	AS Name	CC	Users (est.)	Value (GDP x Users)	% of country (Users)	% of Internet (Users)	V6 Users (est)	% of AS	% of country V6 total
1	AS8452	TE-AS TE-AS	<a href="#">EG</a>	23,827,096	79,773,117,408	72.66	0.689	1,900	0.01	0.88
2	AS36992	ETISALAT-MISR	<a href="#">EG</a>	2,547,366	8,528,581,368	7.77	0.074	212,652	8.35	98.8
3	AS24863	LINKdotNET-AS	<a href="#">EG</a>	2,372,179	7,942,055,292	7.23	0.069	206	0.01	0.1
4	AS24835	RAYA-AS	<a href="#">EG</a>	1,939,716	6,494,169,168	5.91	0.056	161	0.01	0.07
5	AS36935	Vodafone-	<a href="#">EG</a>	1,190,702	3,986,470,296	3.63	0.034	70	0.01	0.03
6	AS37069	MOBINIL	<a href="#">EG</a>	454,063	1,520,202,924	1.38	0.013	35	0.01	0.02
7	AS20928	NOOR-AS	<a href="#">EG</a>	204,627	685,091,196	0.62	0.006	20	0.01	0.01
8	AS29256	INT-PDN-STE-AS STE PDN Internal AS	<a href="#">EG</a>	188,835	632,219,580	0.58	0.006	10	0.01	0
9	AS30993	Egypt-Centers	<a href="#">EG</a>	21,623	72,393,804	0.07	0.001	3	0.01	0
10	AS2561	EUN	<a href="#">EG</a>	12,064	40,390,272	0.04	0	0	0	0
11	AS20184	Yalla-Online	<a href="#">EG</a>	11,551	38,673,710	0.04	0	0	0	0

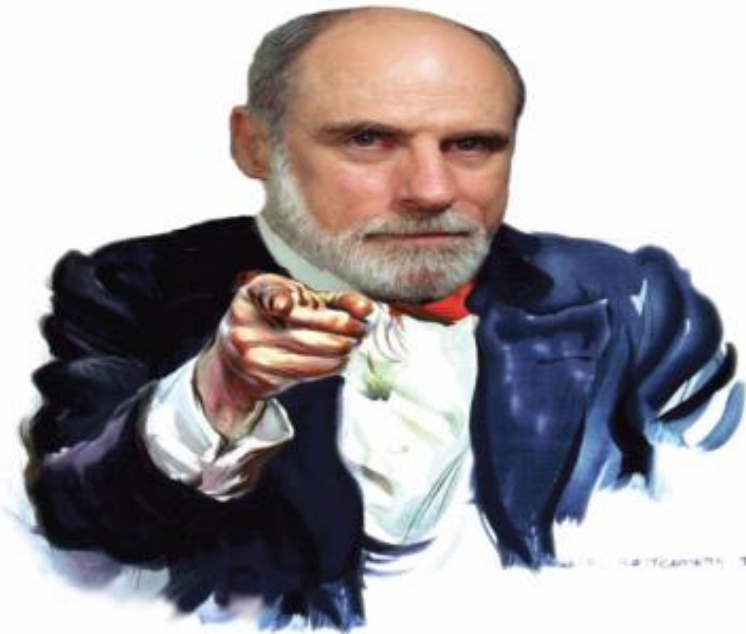
# IPv6 for IoT

**Recommend to all Governments to obtain their own IPv6 Address Space by becoming a LIR with their IP**

**Registry – AFRINIC  
US has done it for IPv4 and  
IPv6**

**Germany has done it in 2016  
to manage its e-Services:  
German-Online**

# Message From Vint Cerf Honorary Chair IPv6 Forum



**I WANT YOU  
TO USE IPv6**

— VINT CERF