Etisalat-UAE
IPv6 Experience

Etisalat / UAE

RIPE Meeting in Dubai (26-30 October 2008)

Abed Al-Moeen Aqrabawi, M/IN Development

August 2008

Speaker:

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About speaker:

- Development Manager - Internet network, Etisalat
- More than fifteen years experience in Internet networking technologies and networking design
- More than nine years with Etisalat working for Internet operations and development
- Designed and implemented many state of the art networking and Internetworking solutions
- Technology and network development member in Etisalat IPv6 task force
- He holds BSC Computer Science degree from the University of Jordan

Agenda

1. IPv6, Introduction

3. IPv6 in UAE

5. IPv6 in Etisalat

IPv6

Introduction

IPv4, Public, Private IP Addresses & Network Address Translation (NAT)

Out of the 4 billion addresses (2^32) in IPv4, four ranges of address are reserved for Private Networking use only. These ranges are not routable outside of private networks and machines using private IP cannot directly communicate with public networks without Network Address Translation (NAT).

Name	IP address range 0.0.0.0 – 255.255.255.255	number of IPs 4,294,967,296	description	Block 0-256/8
24-bit block	10.0.0.0 – 10.255.255.255	16,777,216	single class A	10.0.0.0/8
20-bit block	172.16.0.0 – 172.31.255.255	1,048,576	16 contiguous class Bs	172.16.0.0/12
16-bit block	169.254.0.0 – 169.254.255.255	65,536	256 contiguous class Cs	169.254.0.0/16
16-bit block	192.168.0.0 – 192.168.255.255	65,536	256 contiguous class Cs	192.168.0.0/16

IPv6
Features and differences from IPv4

IPversion.4 (2^32) →→→ IP version 6 (3.4x10^38)

- **Larger address space**
  The main feature of IPv6 that is driving adoption today is the larger address space: addresses in IPv6 are 128 bits long versus 32 bits in IPv4.
- **Stateless address auto-configuration**
  IPv6 hosts can be configured automatically when connected to a routed IPv6 network using ICMPv6 router discovery messages
- **Multicast (FF02::1)**
  Multicast is part of the base specifications in IPv6, unlike IPv4, where it was introduced later.
- **Link Local Addresses**
  In addition to the global addresses, Link local addresses Always exists which simplifies routing
- **Jumbograms**
  In IPv4, packets are limited to 64 KiB of payload. IPv6 can be more than 4 GiB. The use of jumbograms may improve performance over high-MTU networks.
- **Network-Layer Security**
  IPsec, network-layer encryption and authentication, is an integral part in IPv6; this is unlike IPv4, where it is optional (but usually implemented). IPsec, however, is not widely used at present except for securing traffic between IPv6 BGP routers.
- **Mobility**
  Unlike mobile IPv4, Mobile IPv6 (MIPv6) avoids triangular routing and is therefore as efficient as normal IPv6. This advantage is mostly hypothetical, as neither MIPv4 nor MIPv6 are widely deployed today.
- **Simpler processing by routers**
  IPv4 has a checksum field that covers the entire packet header. IPv6 has no error checking at the network layer but instead relies on link layer and transport protocols to perform error checking, which should make forwarding faster.

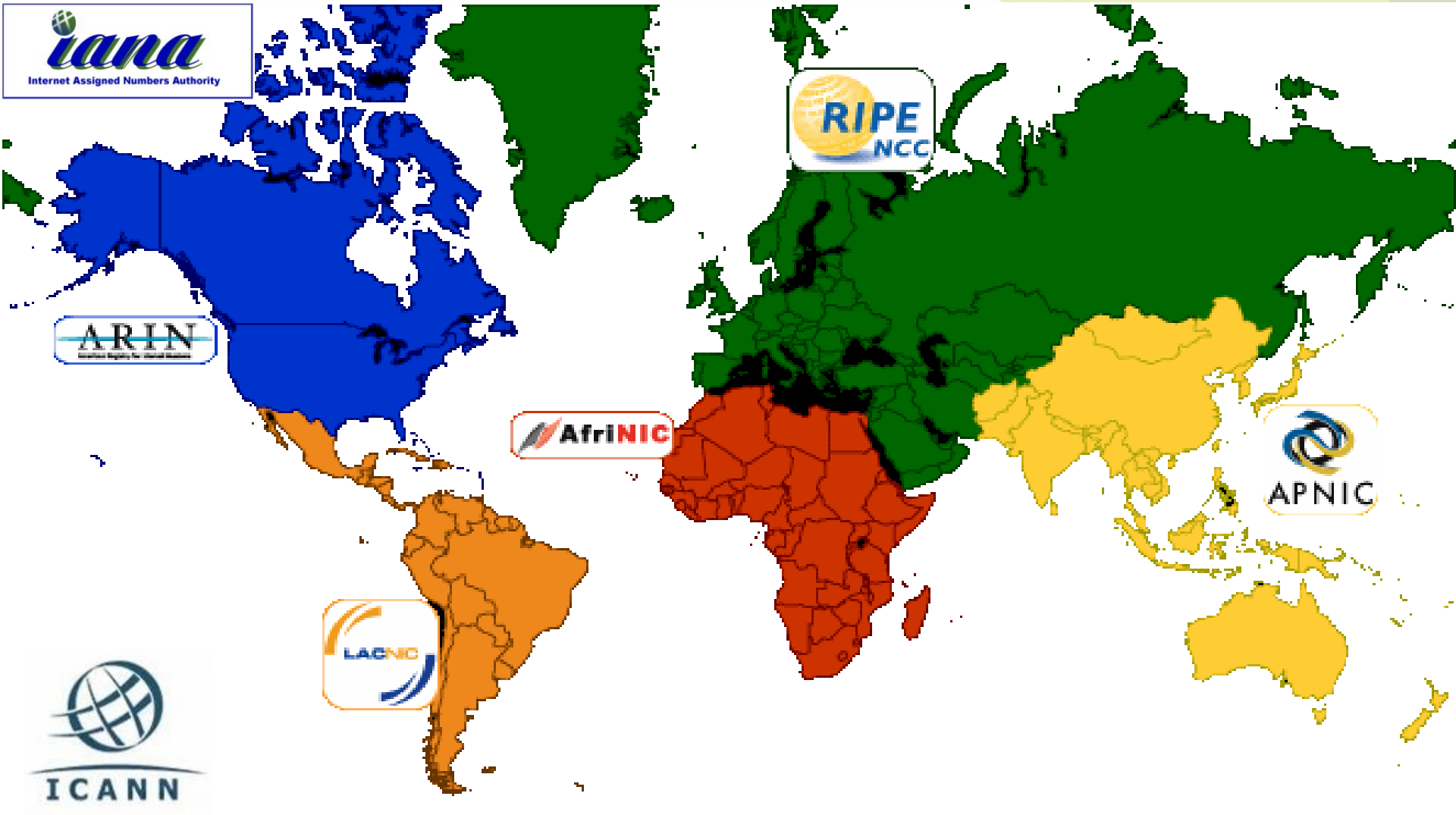
Internet Penetration

- Worldwide Internet Penetration
  - 2005 1 Billion users 15%
  - 2010 1.6 Billion users 25%
  - 2015 2.3 Billion users 35%
  - 2020 3.2 Billion users 50%
- Everything is over IP
- Always-on Technologies
- New Real-Time applications

All of this cannot be achieved with the current Internet based on IPv4+NAT+NAT

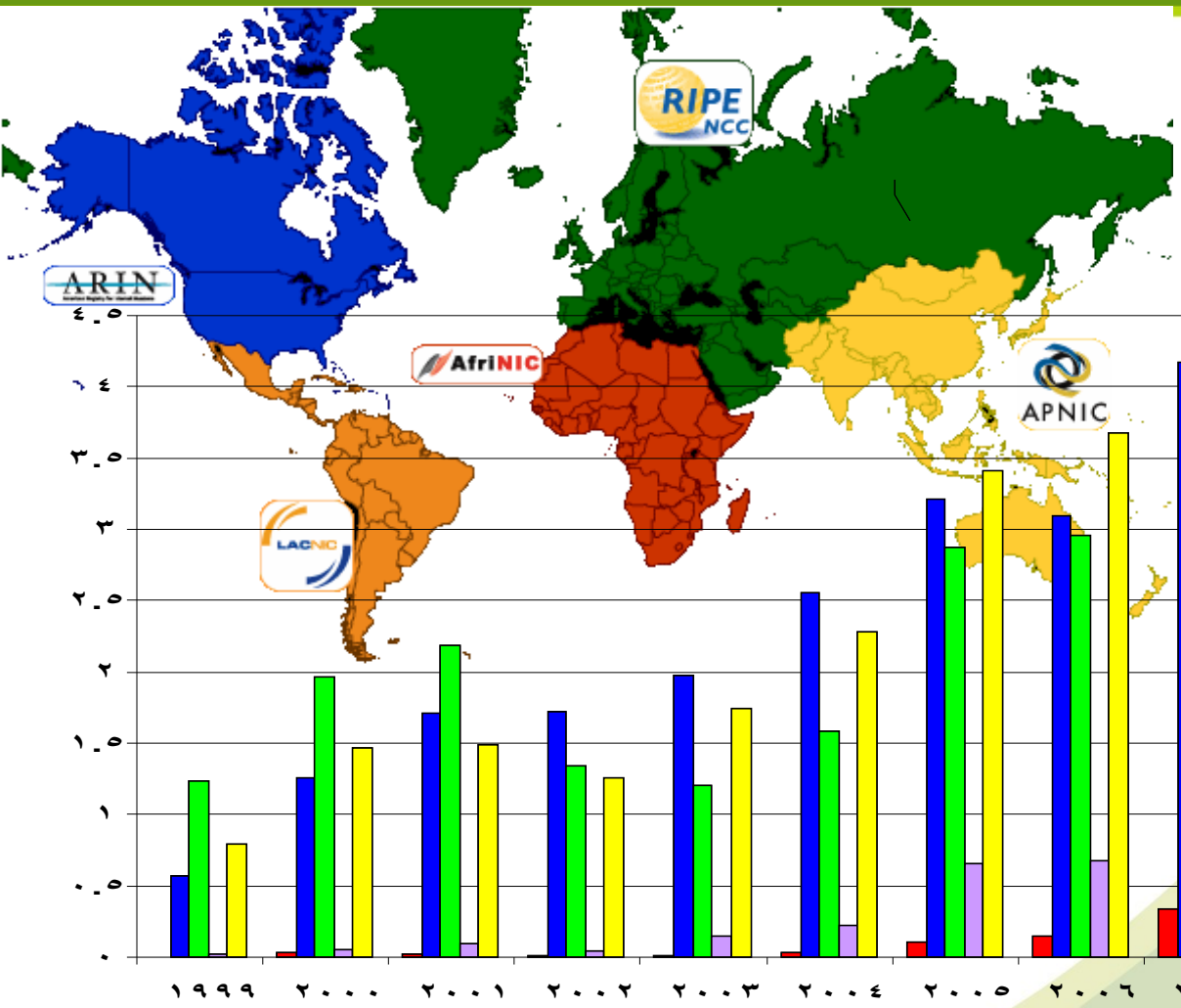
Who is responsible for managing the IPs?
Internet Assigned Numbers Authority (IANA), RIR & LIR

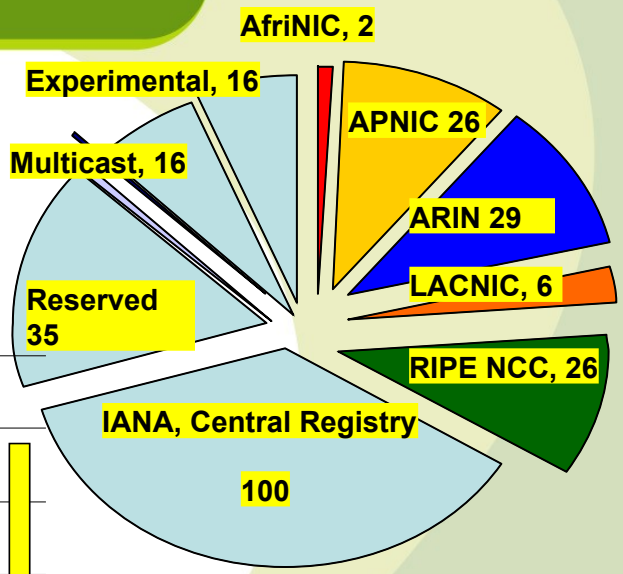
IANA is operated by ICANN



IPv4 Status of 256 /8s
IPv4 Address Space Allocation

http://www.potaroo.net/tools/ipv4/index.html

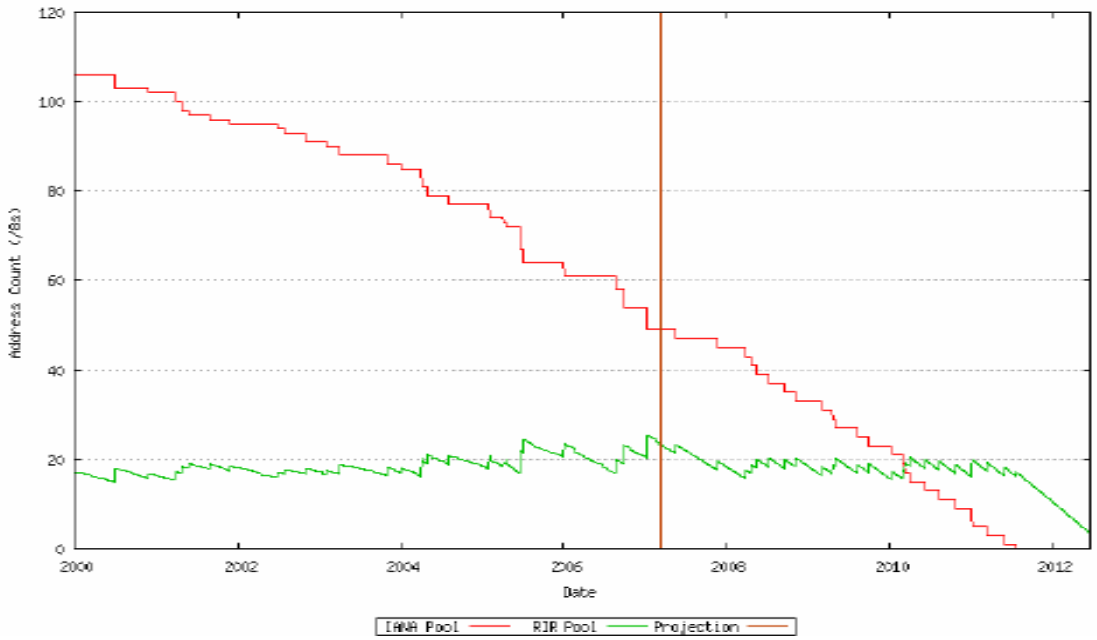




IPv4 Status

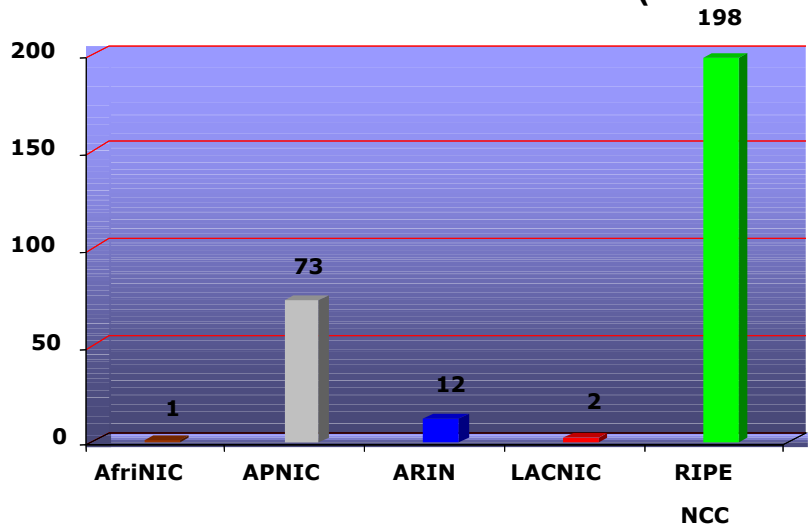
http://www.potaroo.net/tools/ipv4/index.html

- **Projected IANA Unallocated Address Pool Exhaustion: 2011**
- **Projected RIR Unallocated Address Pool Exhaustion: 2012**

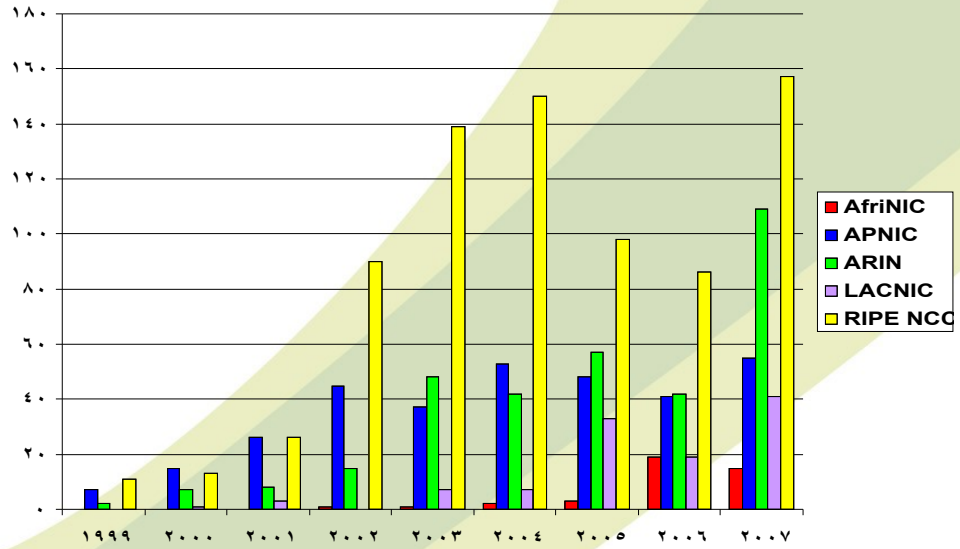


IPv6 Allocations

IANA IPv6 Allocations to RIRs (no of /23s)



IPv6 Allocations RIRs to LIRs/ISPs Yearly Comparison



IPv6 Allocation per Country (Top 10)

world

Pos	Flag	Country	V	A	VP
1		United States	152	530	7.43%
2		Germany	84	149	4.11%
3		Japan	71	113	3.47%
4		United Kingdom (Great Britain)	44	112	2.15%
5		Netherlands, The	30	72	1.47%
6		France	20	56	0.98%
7		Italy	26	49	1.27%
8		Korea	14	47	0.68%
9		Switzerland	19	46	0.93%
10		Canada	16	42	0.78%

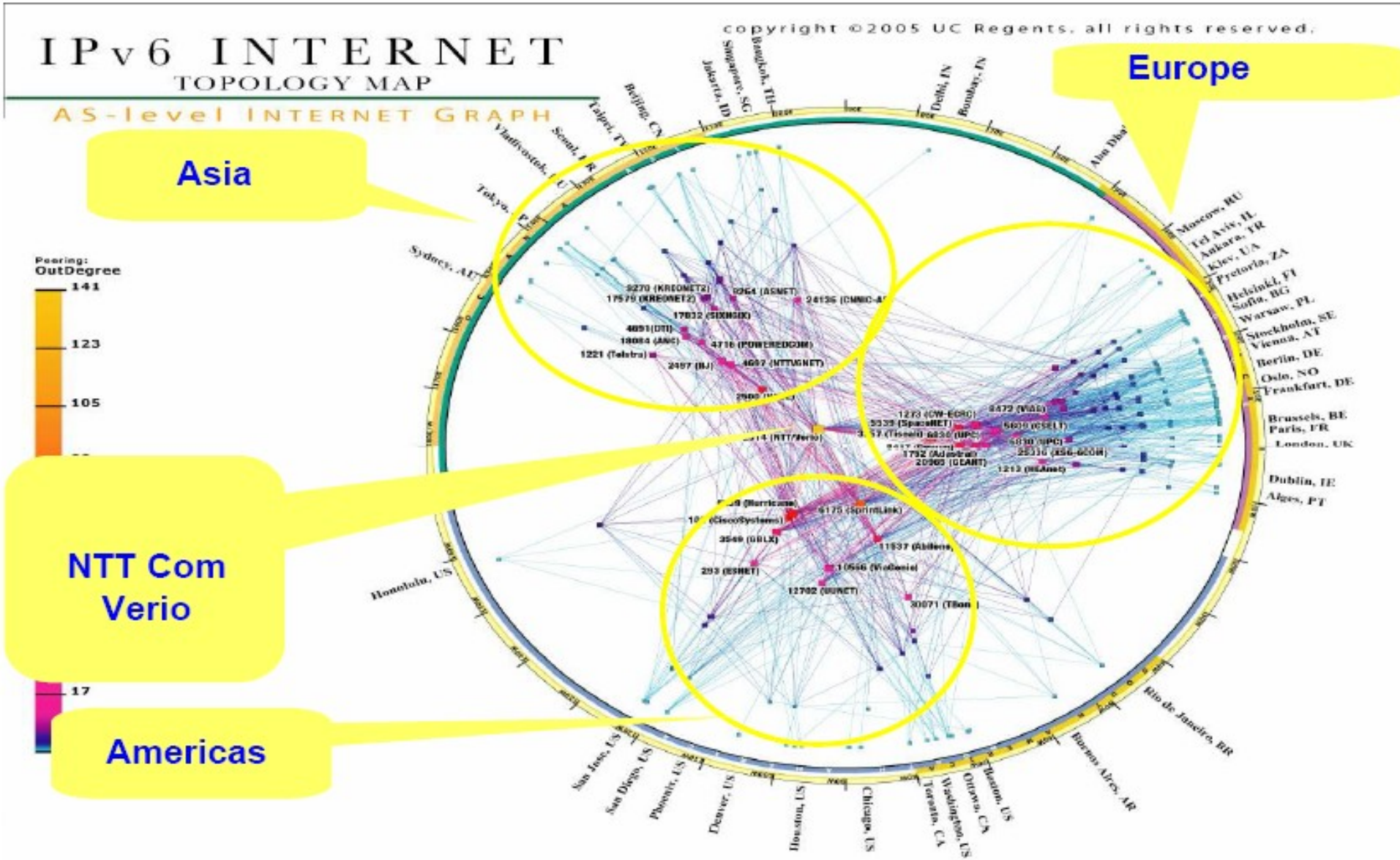
Europe

Pos	Flag	Country	V	A	VP
1		Germany	84	149	9.46%
2		United Kingdom (Great Britain)	44	112	4.95%
3		Netherlands, The	30	72	3.38%
4		France	20	56	2.25%
5		Italy	26	49	2.93%
6		Switzerland	19	46	2.14%
7		Sweden	16	39	1.80%
8		Poland	16	33	1.80%
9		Austria	14	28	1.58%
10		Spain	13	28	1.46%

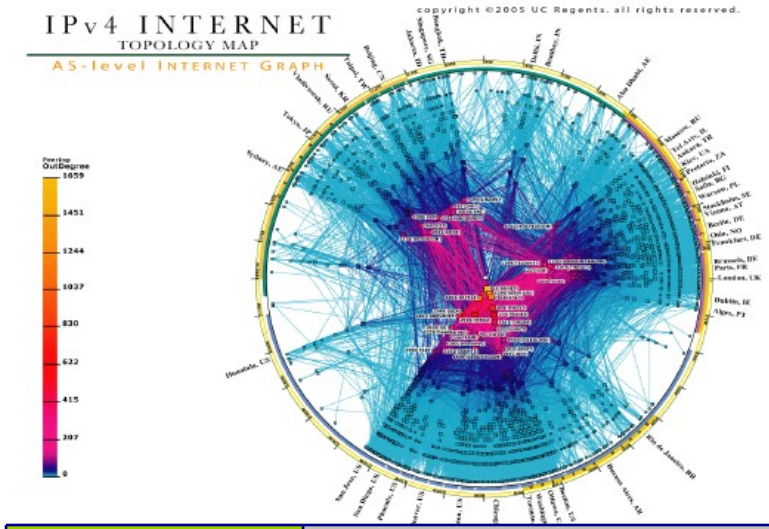
- **UK:** JANET, Verio, Claranet, Leveß, London Internet Exchange, Bogons, Andrews & Arnold, Flag Telecom, BT,..
- **Germany:** DFN, Tiscali, Vodafone,..
- **Japan:** KDDI …
- **China:** China Telecom

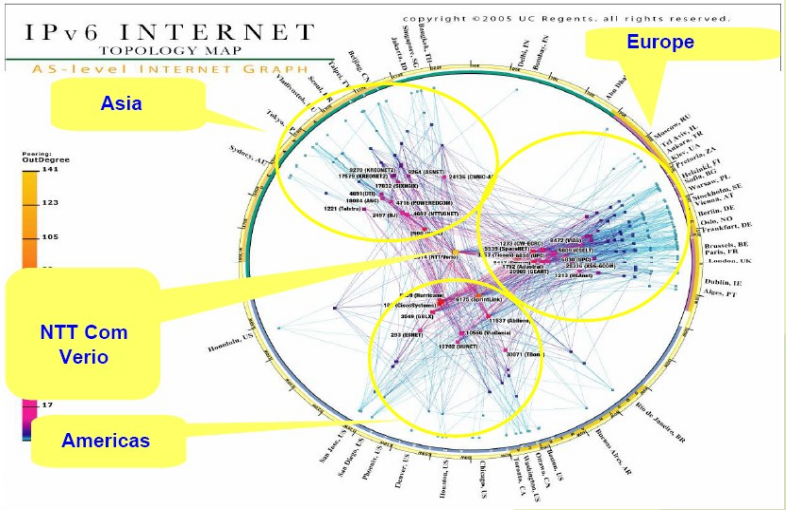
Most major operators have IPv6 trails/research projects ongoing.

IPv6 Internet Topology Map



IPv6 versus IPv4





IP Address	4 Bytes - Running out , NAT - Routing Less Efficient	16 Bytes - massive address space increase - routing much more efficient
Network Address	Manual	Auto configuration (stateless)
Management	DHCP optional	DHPC mandatory (stateful)
(plug & play)	Router Discovery optional	Router Discovery mandatory -Neighbor Discovery detection -Router Renumbering
Security	Retrofit, optional	Mandated standard, integrated and flexible
Quality of Service	Optional, Patched On	Inherent Feature to support QoS -Flow Label, Priority Field
Mobile Networks	Retrofit, Requires -Home and Foreign -Agents	Inherent as Extension Header -in IPv6, Neighbor Discovery -and Auto configuration

IPv6 General Deployment Tips

1. **Most of the definition of IPv6 is under the control of the Internet Engineering Task Force (IETF) refer to http://www.ietf.org**

3. **The IPv6 Forum was created in 1999 to promote and advocate the IPv6 protocols and their deployment http://www.ipv6forum.com**

4. **Got to Know IPv6 basics like:**
   - IPv6 address types and formats
   - ICMPv6, neighbor discovery, security, and mobility
   - IPv6 routing protocol OSPFv3, BGP4+,IS-IS, RIPng, EIGRPv6
   - IPv6 integration and coexistence strategies ,vendors support
   - IPv6 host configuration (Solaris, Microsoft, and FreeBSD)
   - What to test in IPv6 and How !?
   - How to connect to the IPv6 Internet

4. **Got to answer the following: Why (Motivation) !?, What is my strategy?, Scope?, Plan?, Budget?, timeframe ?, and How!? .**

IPv6 Deployment Options

A wide range of techniques have been identified and implemented worldwide, basically falling into the following categories:

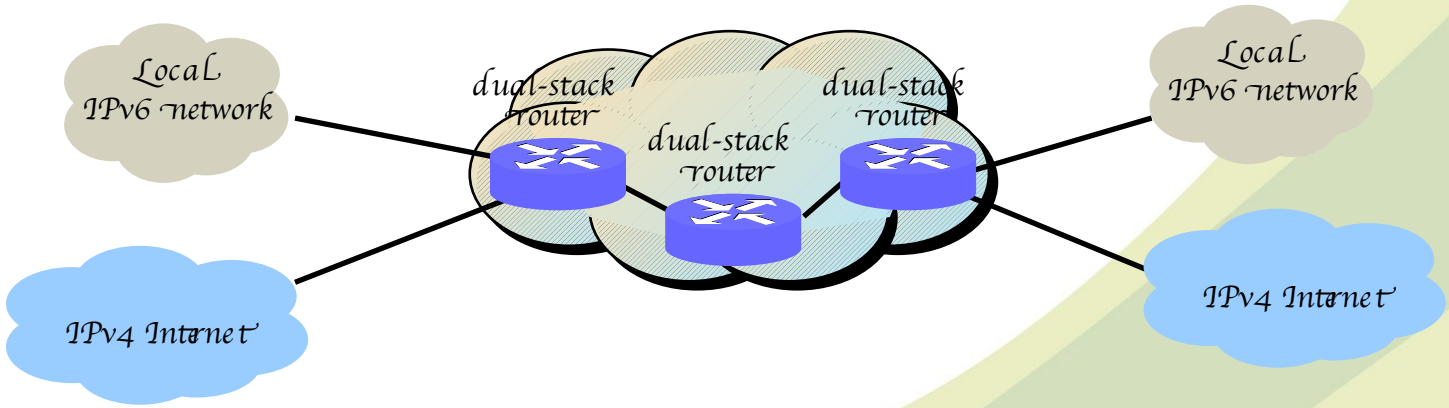
- **dual-stack techniques**, to allow IPv4 and IPv6 to co-exist in the same devices and networks
- **tunneling techniques**, to avoid dependencies when upgrading hosts, routers, or regions
- **translation techniques**, to allow IPv6-only devices to communicate with IPv4-only device
- **Dedicated Data Links**, new IPv6 sites or migrating existing sites.

All of these are used in combination → NEXT

Dual stack (IPv4+IPv6 coexist)

*** All Routers are capable to cope with both protocols**

Pros	Cons
• No additional overhead to manage tunnels • IPv6 is handled as 'normal' IP traffic • Recommended for – Greenfield deployment – Small networks	• Two different configurations in your network (e.g. security for IPv4 and IPv6) • Major network upgrade



IPv6 Tunnels over IPv4
@ the Edges of Non MPLS IPv4 Core Network

2 TYPES: Configured Tunnels & Dynamic Tunnels

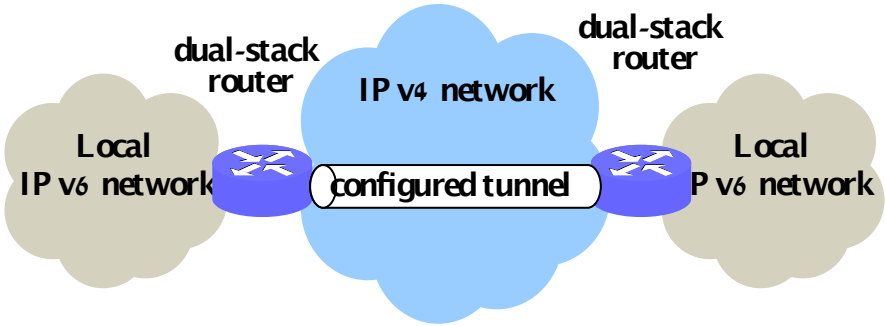
IPv6 packets are carried within IPv4 packets

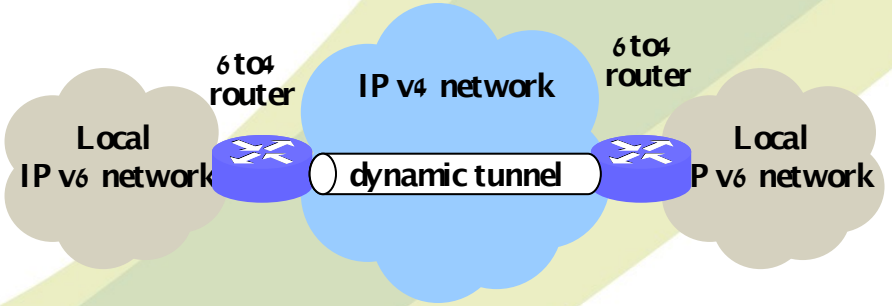
Pros

- Enables IPv6 implementations to take advantage of the existing IPv4 infrastructure without the need to change any of the IPv4 backbone components
- Low cost, low risk approach
- Only dedicated network elements need to support IPv6
- Useful as a first step towards IPv6 in small (non-MPLS) networks

Cons

- High configuration cost and doesn't scale
  - configured tunnels
    - complicated & doesn't scale
  - automatic tunnels (e.g. 6to4)
    - easier and scales better



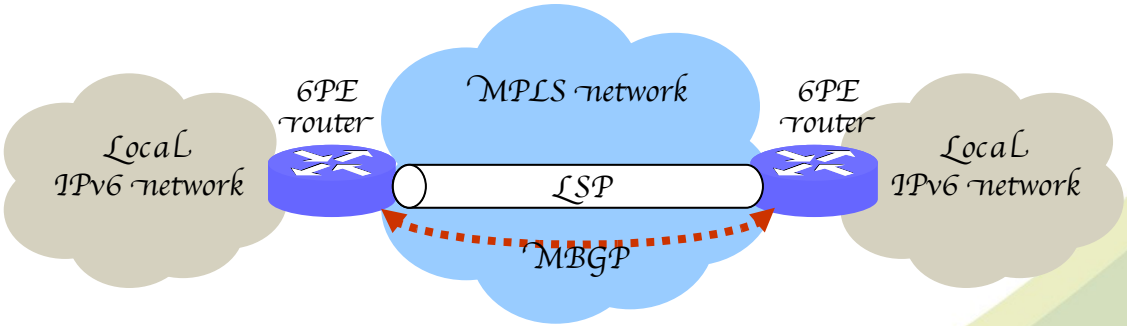


IPv6 Tunnels over IPv4 @ the Edges of MPLS Core Network

All the advantages of the tunnelling scenario plus

- **very clear separation IPv4 / IPv6: gradual evolution**
- **small overhead (MPLS label)**
- **ideal for MPLS cores**

IPv6 over MPLS backbones enables isolated IPv6 domains to communicate with each other over an MPLS IPv4 core network.



IPv6

In the UAE

The IPv6 initiative in the UAE kickstarted by end of year 2000

initiative started by IPv6Forum and Case Technology in UAE , sponsored by Etisalat

UAE migrating to next generation IP system

'COLLECTIVE EFFORT IS NEEDED FOR QUICK CONVERGENCE'

By Stanley Carvalho
Staff Reporter

Abu Dhabi The UAE has initiated moves to achieve a regionwide transition from IPv4 (Internet Protocol Version 4) to the next generation IPv6 (version 6).

A collective effort is needed for quick convergence, a top official said.

"Since 2000, Etisalat has been discussing linking of IPv6 with others in the region but its deployment may take some time if there is no collective efforts from the industry in the region," said Nasser Bin Obood, Deputy Chief Executive of Etisalat.

In his address to the second Gulf IPv6 summit here, Obood outlined the pioneering efforts of the UAE and refinforced Etisalat's vision to be the driving force for change in the vital communications sector.

"We set up the UAE IPv6 task force in February 2001 and built the basic infrastructure in 2002. Currently, we are testing with regional partners for a transition from IPv4 to IPv6. We have tested the technology internally and we are in the process of testing it regionally and internationally."

With about 1.7 million internet users as of February 2005 (41 per cent penetration rate), the IPv6 will help build more applications and greater internet penetration. As the new generation Internet Protocol, the IPv6 is hugely beneficial, especially in creating new IP addresses. "With IPv4, you have 4.3 billion addresses but with IPv6 you can have billions and billions of addresses. Each human being, each machine can have its own unique address."

The UAE IPv6 Task Force comprises experts from the government, the private sector as well as from the energy, banking telecoms and education sectors.

FORUM

Region urged to move fast to IPv6

Latif Ladid, President of IPv6 Forum, urged countries in the region to migrate fast to IPv6 and thus take the internet to the next step.

"The internet is firmly positioned to become the nervous system of our society networking together individuals, businesses and electronic devices to create a truly online world. IPv6 enables this vision facilitating ease of use with a mandate for security and privacy," he told delegates.

First IPv6 Summit in the Gulf held in Dubai in year 2001.

Governmental degree was issued to deploy the IPv6.

Initiative started by IPv6Forum and Case Technology in UAE , sponsored by Etisalat.

His Highness Sheikh Ahmed Bin Saeed Al Maktoum, President of Dubai Civil Aviation and Chairman of the Emirates Group and Vice Chairman of Dubai World Trade Centre (DWTC),

The IPv6 initiative in the UAE kickstarted by end of year 2000

In 2001 initiative started by IPv6Forum and Case Technology in UAE , sponsored by Etisalat

2001 Forming Etisalat IPv6 Taskforce

2005 Second IPv6 Summit held in Abu Dhabi

2005 Forming the UAE IPv6 Taskforce

2008 The Third IPv6 Summit held in Abu Dhabi
(Hosted By Abu Dhabi Chamber of Commerce)

IPv6 Task Forces around the world by IPv6FORUM

http://www.ipv6forum.org/

- Australia
- Austria
- Belgium
- Brazil
- Bretagne
- California
- Canada
- China
- Colombia
- Croatia
- Cuba
- Denmark
- **Egypt**
- Europe
- Finland
- France
- Germany
- Hong Kong
- India
- Ireland
- Israel
- Italy
- Japan
- Korea
- Latin America
- Luxembourg
- Luxembourg
- Malaysia
- Malta
- Mexico
- MidAtlantic
- **Morocco**
- Nepal
- Netherlands
- North America
- Pacific Islands
- Pakistan
- Peru
- Philippines
- Poland
- Portugal
- Russia
- Senegal
- Slovakia
- Spain
- Switzerland
- Taiwan
- Thailand
- **Tunisia**
- UK
- **United Arab Emirates**

Latif Ladid
Chairman

2005 Second Summit in Abu Dhabi & Forming the UAE IPv6 Taskforce

Participation: ISP's responsible, IT decision makers (320 attendees)

The Logo

IPv6
UAE IPv6 Task Force

INTERNET

Abu Dhabi summit to discuss new protocol

Etisalat teams up with the organisers and Case Technology to make the conference on March 29 and 30 a success

Staff Report

Dubai A ground-breaking new internet protocol will be up for discussion during an upcoming conference in Abu Dhabi on IT issues, organisers said.

IPv6 (Internet Protocol Version 6) is the next generation protocol designed by the IETF (Internet Engineering Task Force). It is intended as a replacement for the current Protocol, IP Version 4 (IPv4).

Most of today's internet relies on IPv4, which is about 20 years old. As a result, there is a growing shortage of IPv4 addresses, which are needed by all new machines added to the internet.

The IPv6 Summit will run on March 29 and March 30. Etisalat has teamed up with the event's organisers and Case Technology to make the summit a success.

"Etisalat's position as a regional leader in bringing in state-of-the-art technology services to the region is reflected by our sponsorship of this summit," said Mohammad Al Fahim, Etisalat's executive vice-president, marketing.

"Etisalat has already committed substantial resources to incorporate this protocol in our network. We look forward to sharing our experience and exchange insights with other participants from the region," he said.

"As devices and applications dependent on the internet increase in number, people need new IP addresses," said Abdullah Hashim, senior manager, eCompany.

"All this increasing demand means the rise of new market opportunities. I am confident that this summit will help highlight the benefits of deploying IPv6 and give attendees insights into its applications in different areas."

"As a founder of worldwide IPv6 Forum, Case Technology has taken the lead in creating the awareness and we are in the process of forming the IPv6 Middle East and UAE Taskforce to deploy IPv6 in the region," said Itidal Hasoon, general manager, Case Technology.

Hasoon is also co-chair of the Middle East and Africa Internet Protocol Version 6 Task Force.

"This taskforce will promote and help the region embrace IPv6 and move towards its deployment in a phased manner," he said.

SPONSORS:

CASE TECHNOLOGY / NATIONAL BANK OF ABU DHABI / SIEMON COMPANY /ETISALAT

UAE IPv6 Task Force

UAE IPv6 Task Force objectives

- To discuss the deployment of IPv6 within UAE IP Networks.
- To raise awareness among UAE community
- To discuss IPv6 Regulations, Requirement, Applications, Business opportunities, developments & Issues relevant to UAE.
- Creating Forums and Communicate with others
- Our Goal is : Smoothly implement IPv6 in UAE

Task Force Sectors:

The 3rd Gulf IPv6 Summit
18th March 2008

Sponsors of IPv6 summits:-

- CASE TECHNOLOGY
- ETISALAT
- CISCO

Speakers

- IPv6 Forum
- Cisco
- IPv6 Promotion Council – Japan
- France Telecom
- Enteos
- VSNL/ TATA
- Case Technology
- Etisalat

ABU DHABI CHAMBER OF COMMERCE & INDUSTRY
غرفة تجارة وصناعة أبوظبي

H.E Salah Salem Bin Omair Al Shamsi
President of ADCCI

IPv6

in

Etisalat

Etisalat Services (ALL IP Based)

www.etisalat.ae

Home and Business Services

- Narrowband Access
- Broadband Access
- Leased Circuits
- VPN
- 2.5G, 3G & 3.5G Mobile Services
- IPTV, VOD Services
- Triple Play
- VoIP
- Data Center Services
- Value Added Services
- & More

Welcome to Etisalat

Emirates Telecommunications Corporation- Etisalat

Etisalat has been the telecommunications service provider in the United Arab Emirates since 1976 and is the number one mobile operator in the UAE. For three decades, since the birth of the UAE, it has played a key role in driving and supporting the nation's prosperity. Famous for over 30 years for delivering technological excellence, innovation and reliability.

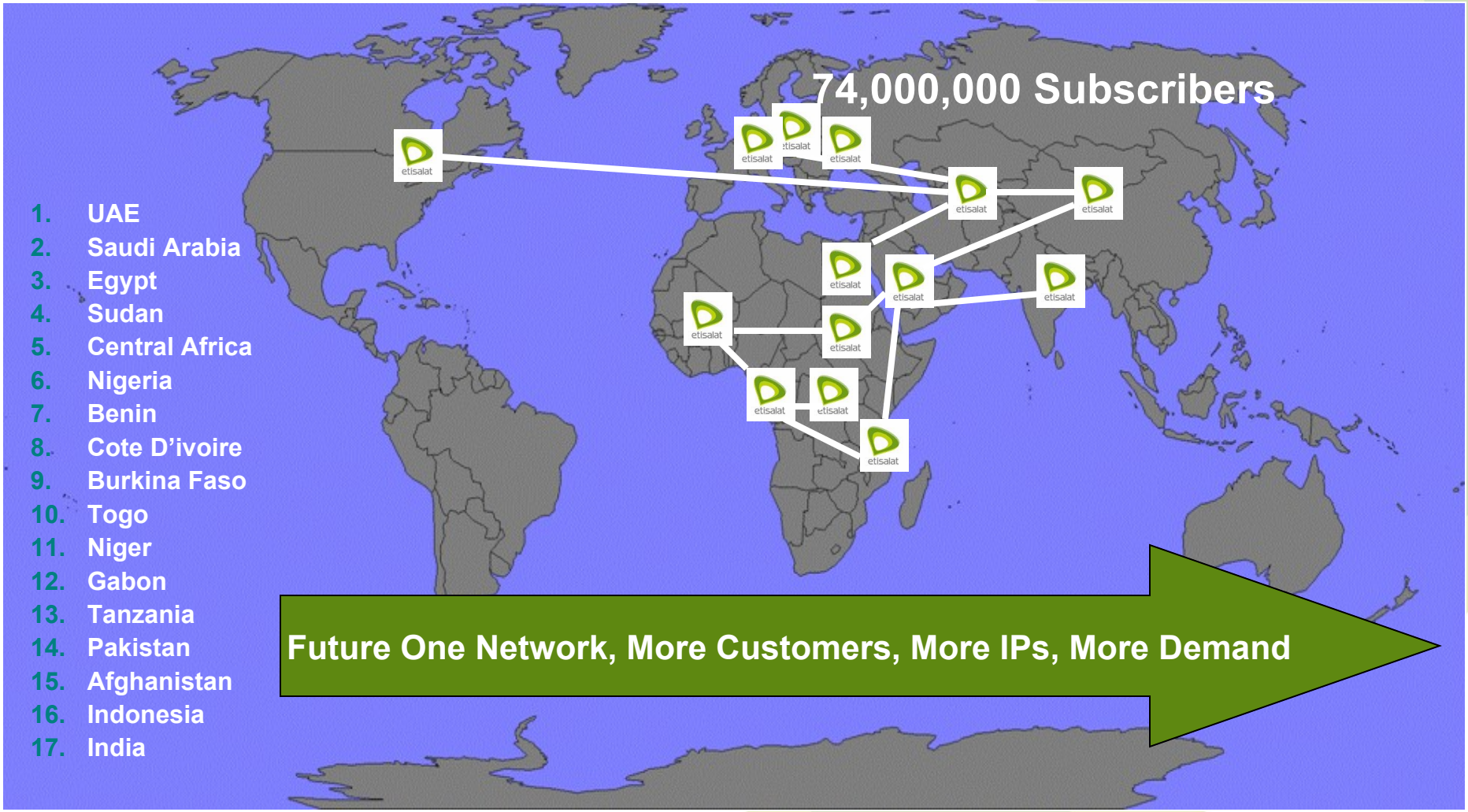
*Etisalat is on track to be one of the top 10 operators by 2010.

•Etisalat ranked as one of the twenty largest operators in the world and the largest in the Arab world by "Financial Times".

•Etisalat ranked as the fastest growing mobile operator in the world, study done by "Information Group"

Etisalat map, Growth, Demands for IPv6

17 Countries



Etisalat and UAEnic (Local Internet Registrar)

- Etisalat is a Local Internet Registry (LIR) for IP Address. It is member in RIPE NCC since 1995 represented by UAEnic
- UAEnic is division in Etisalat.
- Etisalat has very tight relationship with RIPE NCC. Etisalat was selected by RIPE NCC to be the first Telecom in the Middle East to host RIPE Regional Meeting in 2003 in Dubai.
- Again, Etisalat has won hosting the RIPE 57 Meeting
- The .AE CCTLD DNS is IPv6 ready.

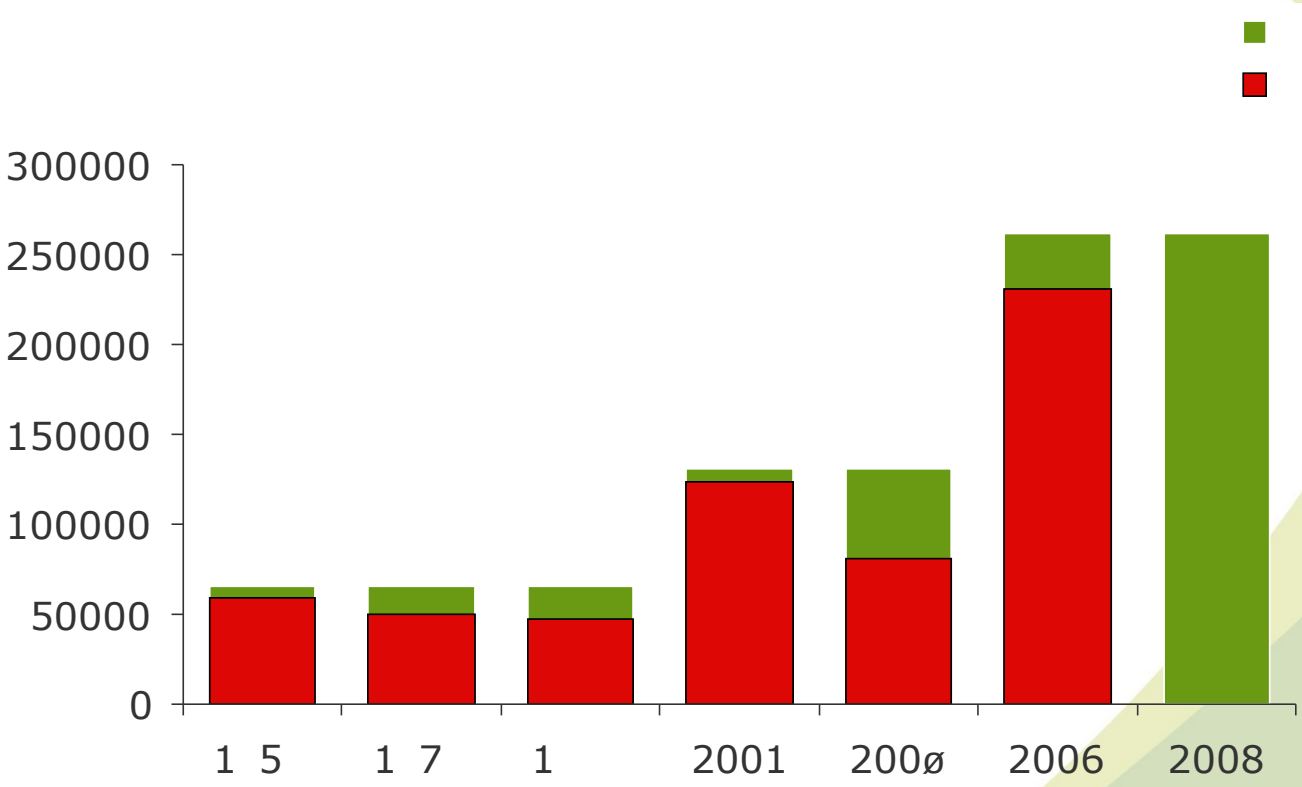
IPv4 Utilization in UAE

Source : UAEnic

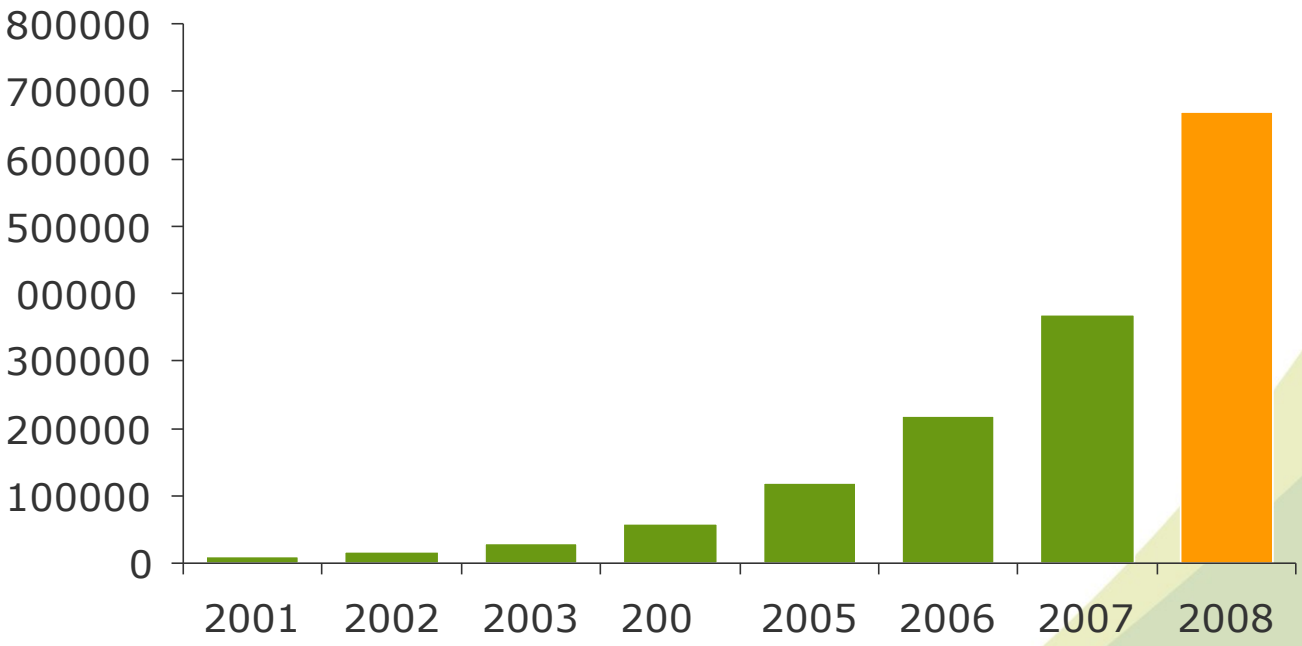
Year	IP Address Ranges	No. of IP Per Range	Used	Free
1995	194.170/16	65,536	59240 (90.40%)	6296 (9.60%)
1997	195.229/16	65,536	50025 (76.30%)	15511 (23.70%)
1999	213.42/16	65,536	47491 (72.50%)	18045 (27.50%)
2001	217.164/15	131,072	123840 (94.50%)	7232 (5.50%)
2004	83.110/15	131,072	80664 (61.50%)	50408 (38.50%)
2006	86.96/14	262,144	231273 (88.20%)	30871 (11.80%)
2008	92.96/14	262,144	0	262144
	Total	**983,040**	**592,533 (60%)**	**390,507**

Etisalat IPv4 Utilization Chart

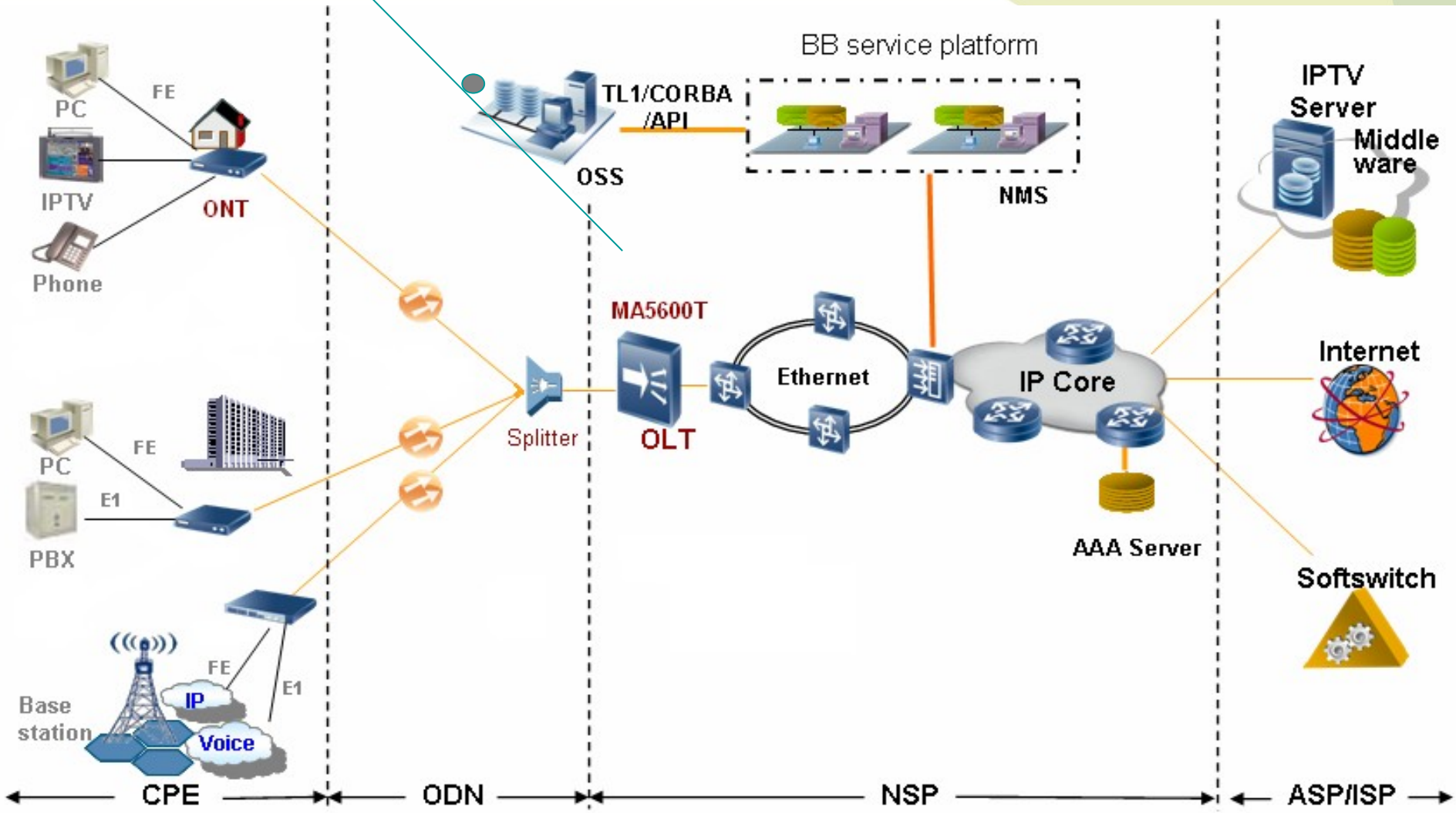
UAEnic



Etisalat Internet Broadband Growth

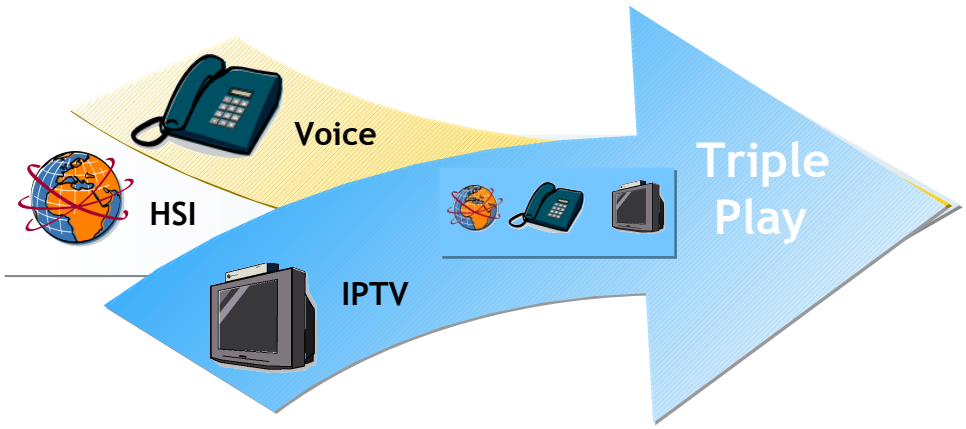


Etisalat 3Play over GPON is end-to-end IP Solution



3-Play IP Requirements, A need for IPv6

- One IP address for every ONT
- One IP address for every Set top Box (STB) for the IP TV.
- One IP address for every VoIP phone.
- One IP address for every High speed Internet Access.



Growth and Demand for IPv6

The increasing need for IP addresses is well known by Etisalat

- The number of broadband users is increasing based on xDSL, DOCSIS, WiMax and other access technologies
- The number of subscribers in mobile networks (3G/3.5G) is increasing much faster than in fixed line networks.
- Customers use more and more “always on” access for established services, for example Peer-to-Peer
- The types of terminals for mobile and fixed access are increasing

The number of IP addresses needed is increasing fast,
NAT alone can no longer be seen as the solution

Objectives of IPv6 in Etisalat

IPv4 will run out by 2011/2012 ….. We shall be ready.

- Continue leading the region by having early deployment of IPv6 and represents the UAE and Etisalat in the National & International events
- Getting experience with IPv6 by knowing the advantages and limitation of it and assist in troubleshooting to gain the technical knowledge
- Build scalable IPv6 test network to ensure IPv6 standards compliance for Etisalat current and future systems. And to establish test environment to evaluate the compliance of hardware and software with IPv6 standards
- Work towards exposure of the IPv6 standards within Universities, Colleges and Research Centers in UAE.

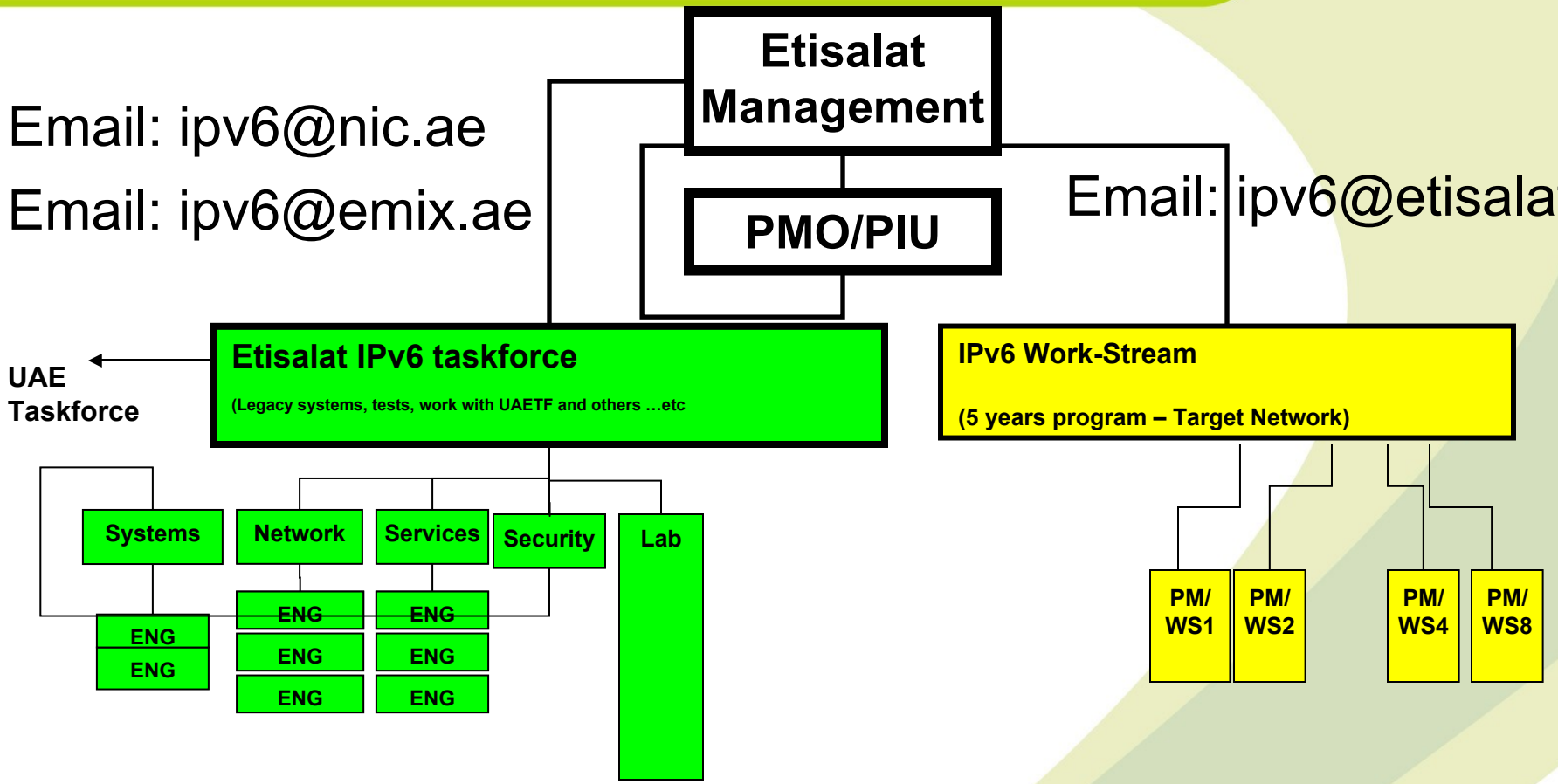
IPv6 Organization in Etisalat

http://www.ipv6.ae

Email: ipv6@nic.ae

Email: ipv6@emix.ae

Email: ipv6@etisalat.ae



http://lab.ipv6.ae

Contract Clause Added - 2001

SICET-2A (RFP) : Clause, IPv6 Support

- **All the supplied systems (hardware/Software) wherever IP connectivity is required should support IPv6 and IPv4 (simultaneously if required) with latest standards of IETF, ITU, ANSI and other governing Communication standards.**

- **If the system is not compliant to the above, the supplier should indicate the roadmap to implement IPv6 and clearly state when the system would be compliant to IPv6. The upgrade should be free of cost.**

- **Further the vendor should confirm that the product would be kept abreast with the IPv6 development.**

Note:- For existing systems Concerned sections should obtain the “Statement of Direction towards IPv6” from the Vendors who supplied those systems.

Etisalat IPv6 History

Year 2001-2008

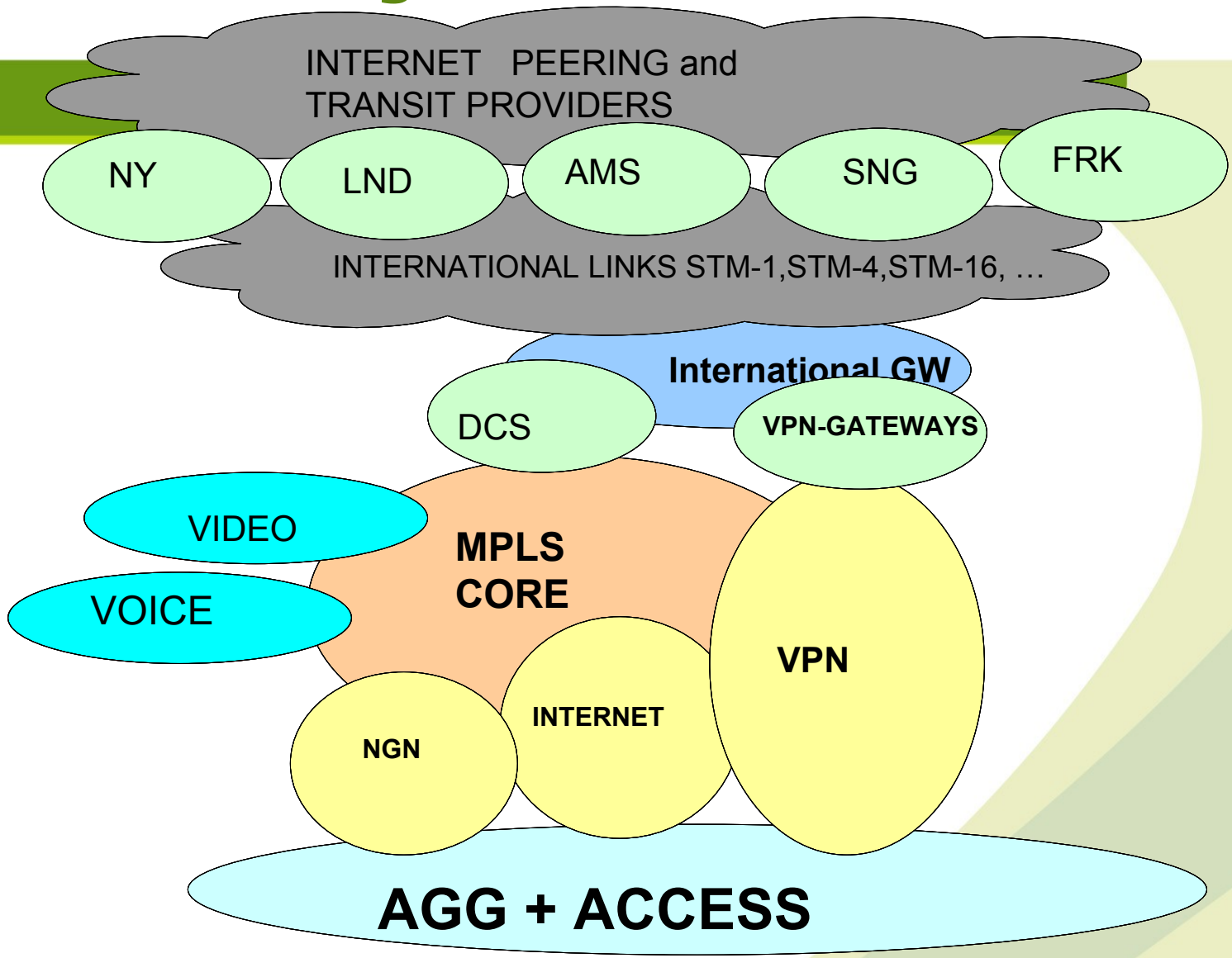
Form Etisalat IPv6 Task Force & Steering committee	May, 2001	Completed
Test IPv6 with 6Bone (via SPRINTv6)	Oct, 2001	Completed
Obtain Global Unicast IPv6 Addresses from (RIPE NCC)	Oct, 2001	Completed
Building Etisalat Basic IPv6 test network	Feb, 2002	Completed
Building Etisalat IPv6 Systems Infrastructure. (DNS,WEB)	July, 2003	Completed
www.ipv6.ae , Lab.ipv6.ae Publishing.	Oct, 2003	Completed
Verifying networks and services elements IPv6 support.	May, 2004	Completed
Testing with regional ISPs and with EMIX Customers.	N/A	In Progress
IPv6 implementation plan 2007-2011	2007	Yearly
First IPv6 production network (ZBL Network Development & NOC)	Jan, 2008	RFS

Year 2008 Highlights

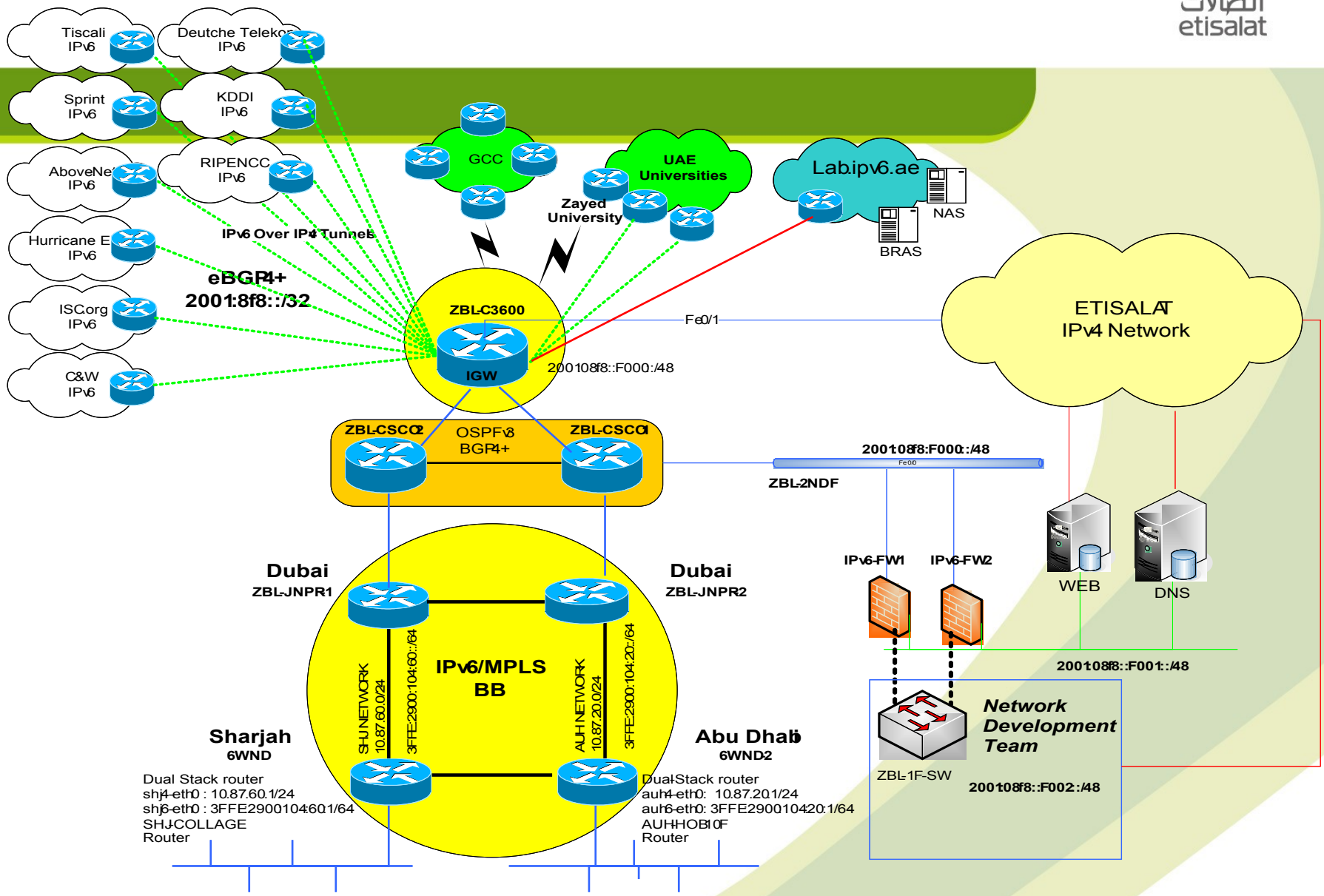
- Connectivity with research centers within UAE (Native and Tunneling)
- Focus on IPv6 applications
- Establish native IPv6 connectivity with GCC/ EMIX Customers and providers
- Convert Etisalat Office (Zabeel) production VLANs to IPv6.
- More resource dedication for the ownership of Etisalat IPv6 lab
- Increase IPv6 peering with Telcos and ISPs worldwide
- Establish native IPv6 peering in EMIX international PoPs
- Lead the IPv6 initiative on a national wide, by promoting and creating awareness on the next generation protocol IPv6 in the community
- Expand the existing setup of IPv6 to include all the society sectors: eGov, Banks, Universities, Companies and Home users

Etisalat IPv6 Roadmap

Etisalat - UAE
IPv4 Converged Network



Etisalat IPv6 Network



IPv6 Peering

- Etisalat has IPv6 peering over IPv4 with the following operators:

- Sprint
- Abovenet
- Hurricane Electric
- Tiscali
- Deutsche Telekom
- ISC , F-root DNS
- QTel
- C & W
- KDDI
- RIPE – k-root DNS

Test-beds

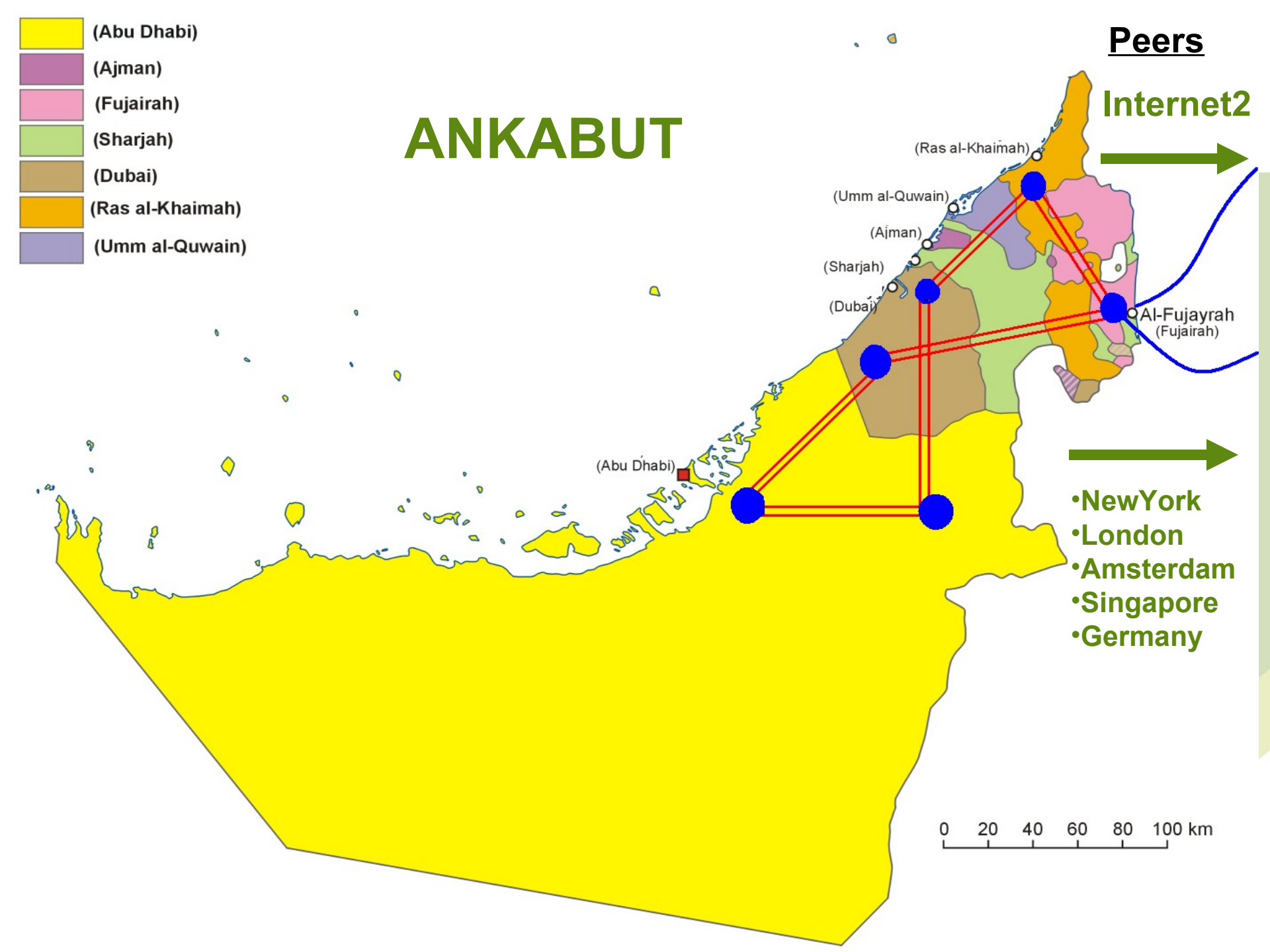
- Etisalat has established test-bed with the following:

  - 6Bone via Sprintv6 - 2001
  - QTel in Qatar
  - Zayed University
  - Khalifa University of Science, Technology and Research
  - Etisalat Academy

UAE ANKABUT Network

The first production IPv6 network in the region, similar and connected to Internet2

- ANKABUT is U.A.E's own NREN.(High Speed Dedicated Network for Research and Education in the UAE).
- Creates an opportunity for the UAE to lead in Research and Education fields.
- Provides connectivity with peers at the international level to effectively participate and collaborate in research activities.
- Provides IP Connectivity for universities to connect their branches in secure method.


(Abu Dhabi)
(Ajman)
(Fujairah)
(Sharjah)
(Dubai)
(Ras al-Khaimah)
(Umm al-Quwain)
ANKABUT
Peers
Internet2
(Ras al-Khaimah)
(Umm al-Quwain)
(Ajman)
(Sharjah)
(Dubai)
Al-Fujayrah
(Fujairah)
(Abu Dhabi)
•NewYork
•London
•Amsterdam
•Singapore
•Germany
0 20 40 60 80 100 km

What is Internet2

Internet2 is a not-for-profit advanced networking consortium comprising more than **200** U.S. universities in cooperation with **70** leading corporations, **45** government agencies, laboratories and other institutions of higher learning as well as over **50** international partner organizations. Provides connectivity with peers at the international level to effectively participate and collaborate in research activities.

ANKABUT Applications

the following are seen to be the main driving ANKABUT applications:

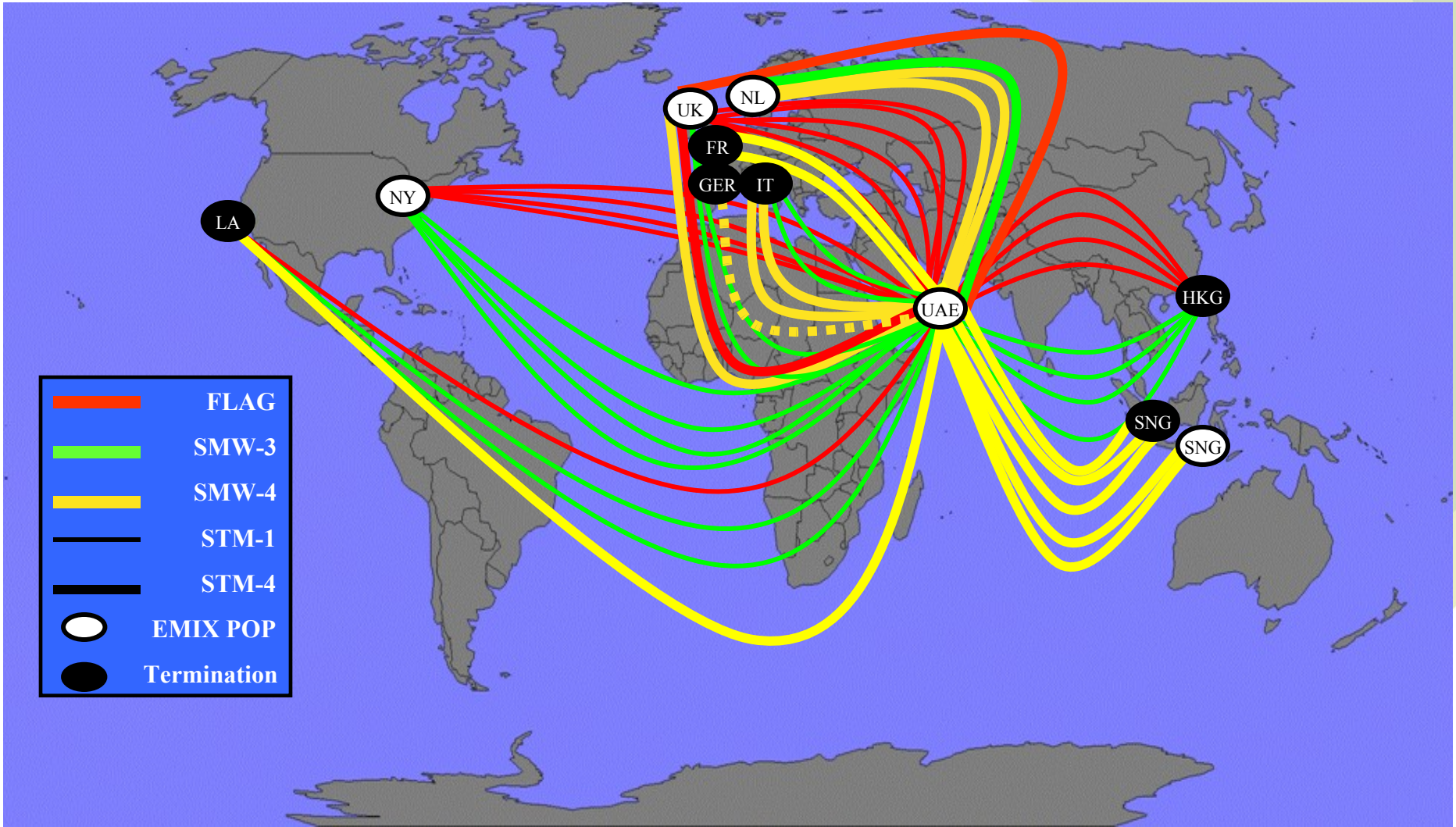
- Videoconferencing
- File Transfer & Browsing (Multimedia Content)
- VPN
- VoIP
- Astronomy, Geology, Satellite Imaging
- Virtual Tours (museums, Zoos, Parks), VR, Tele-immersion
- Collaboration & Application Sharing
- GRID Computing
- Inter-Library services
- DVB, VOD and HDTV
- News and Directory Services
- Network Research (using network data collected at Various ANKABUT Network Measurements Servers deployed on the main POPs), research can cover:
- Security
- Optimisation
- QoS
- IPv6
- e-Learning, distance education, Webcasting, training

Etisalat Contribution in IPv6

- ✓ Member of the IPv6 Forum since the year 2000
- ✓ First in the region to test the IPv6 with 6Bone 2001
- ✓ First in the region to obtain IPv6 Global Address Space **2001:8f8::/32 = 2 ^ 96) in Sep 2002.**
- ✓ First to present/showcase IPv6 in the RIPE NCC regional meeting in 2003
- ✓ First to present IPv6 in the regional symposium on eGoverment
- ✓ First to present the IPv6 in the ITU/BDT Arab regional meetings
- ✓ The First IPv6 task force in the UAE
- ✓ Sponsor for the first Gulf IPv6 summit in 2001 in Dubai with Case Technologies
- ✓ Sponsor for the second regional IPv6 summit 2005 in Abu Dhabi with Case Technologies
- ✓ Etisalat awarded network pioneer for its initiatives on IPv6 in the middle east by network middle east magazine June,14 2005
- ✓ Etisalat actively participated in most IPv6 events around the world since 2001

EMIX Provider

EMIX International Connectivity



IPv6 & EMIX

- Run BGP4+ Routing protocol
- Peering with IPv6 International Providers
  - Dedicated (Native) IPv6 links
  - IPv6 over IPv4 tunnels with peers
- Peering with EMIX customers
  - Dedicated (Native) IPv6 Links
  - IPv6 over IPv4 tunnels
- Providing IPv6 Connectivity

Thank
You