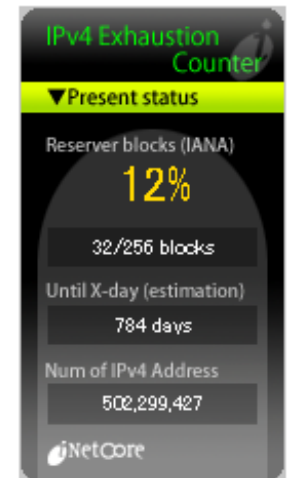

IPv4位址枯竭因應策略

黃仁竑 教授

中正大學資工系

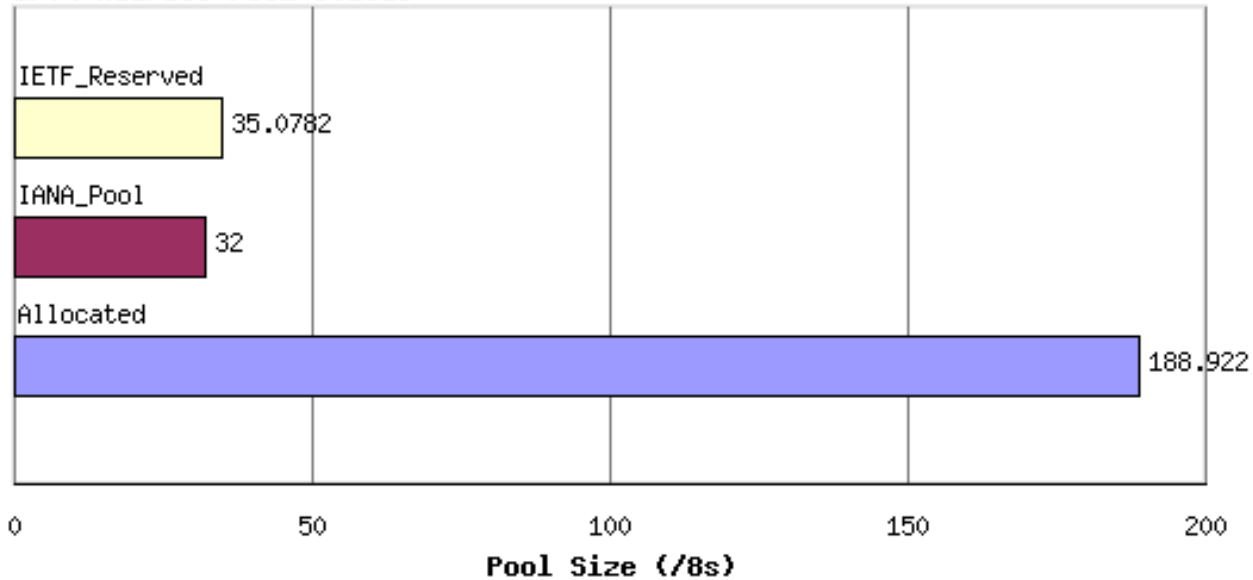
Outline

- 現況介紹
- 因應措施
 - 位址回收與轉移
 - 使用NAT等技術延緩IPv4位址需求成長
 - 使用IPv6
- 問題與討論



現況

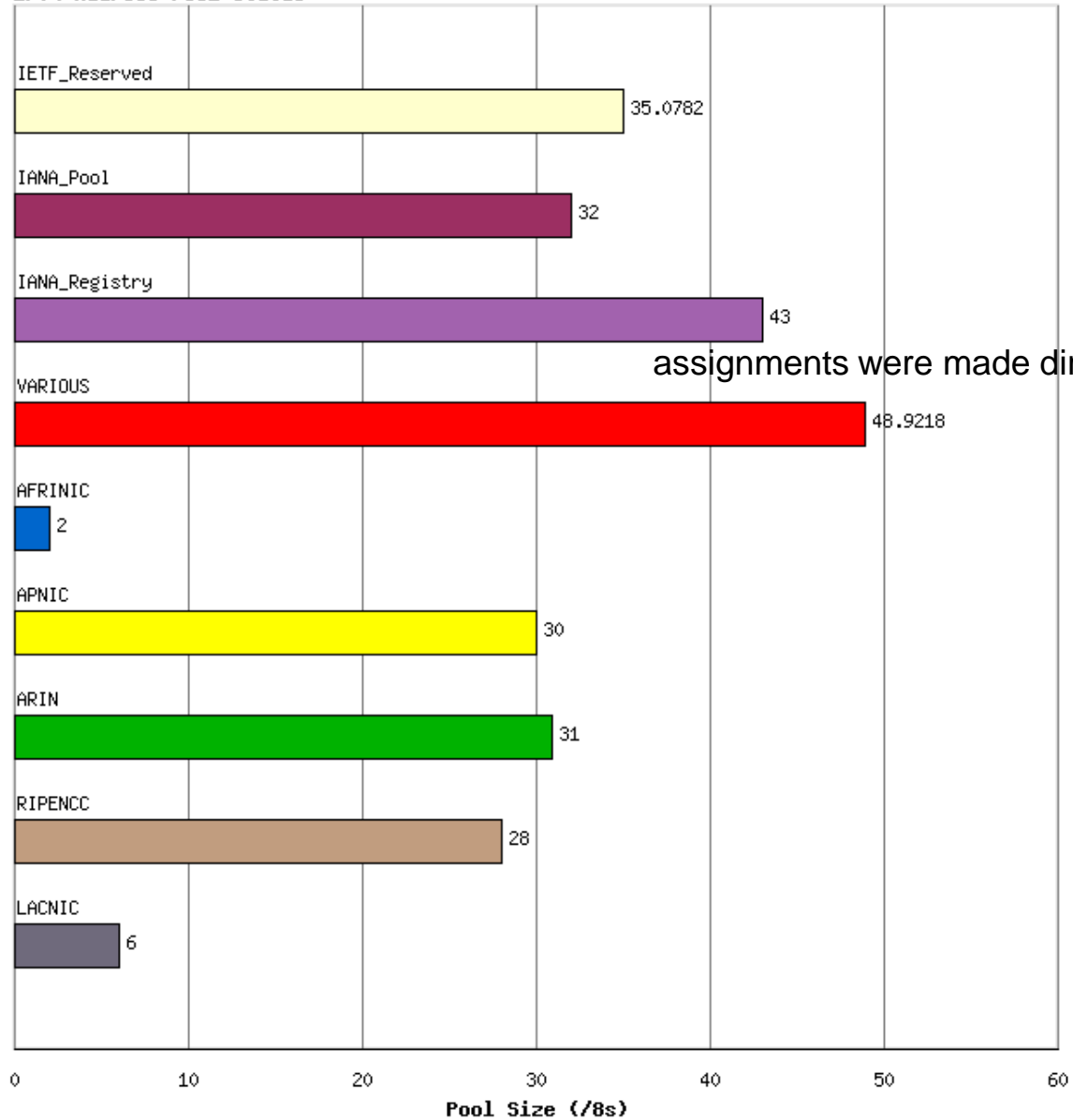
IPv4 Address Pool Status



2009/3/25

現況

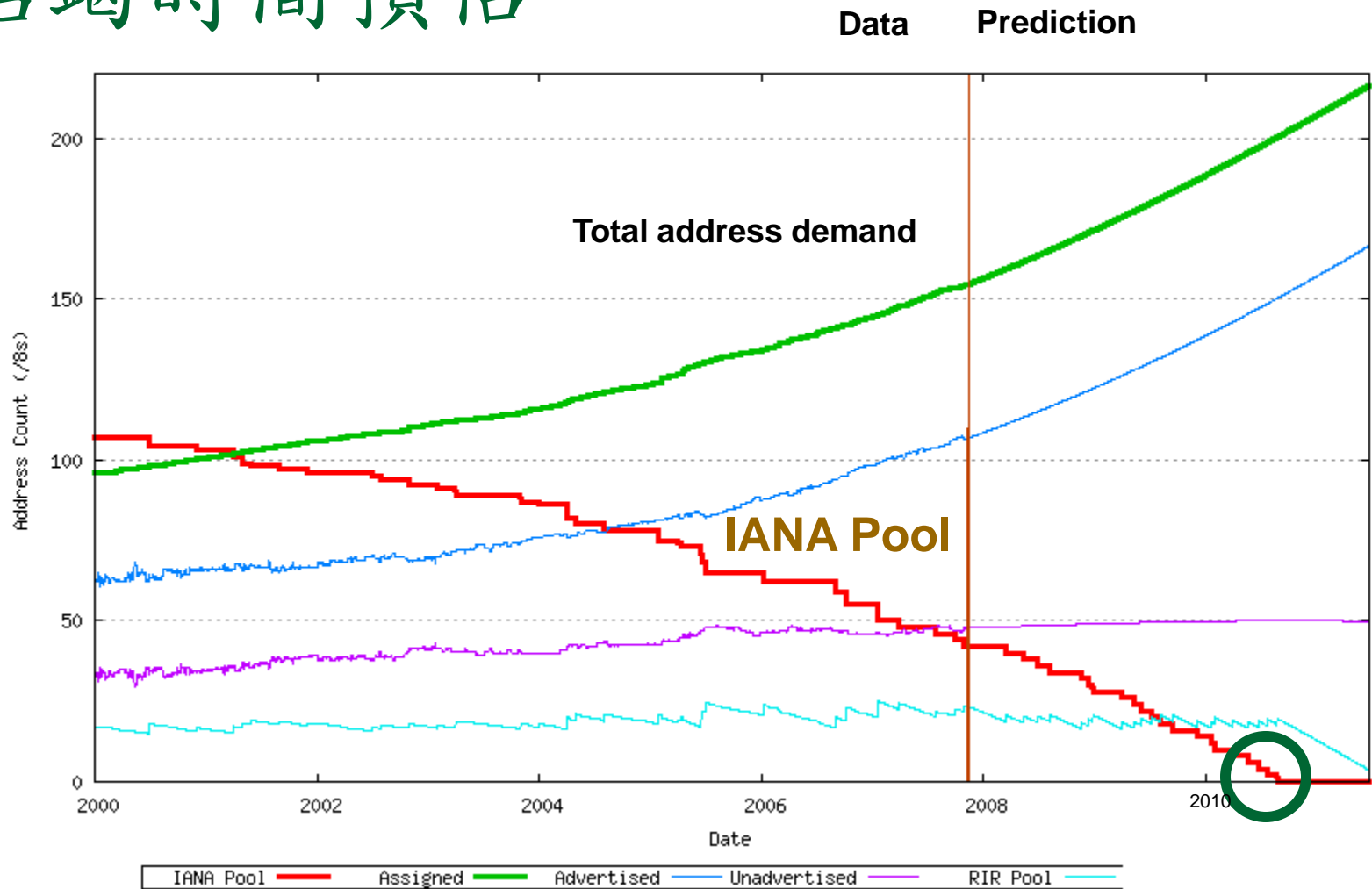
IPv4 Address Pool Status



assignments were made directly by the IANA

Various: [IANA IPv4 Address registry](#) where a number of /8 blocks were assigned prior to the commencement of today's RIR system

枯竭時間預估



Exhaustion of IANA unallocated pool: **May-2011**

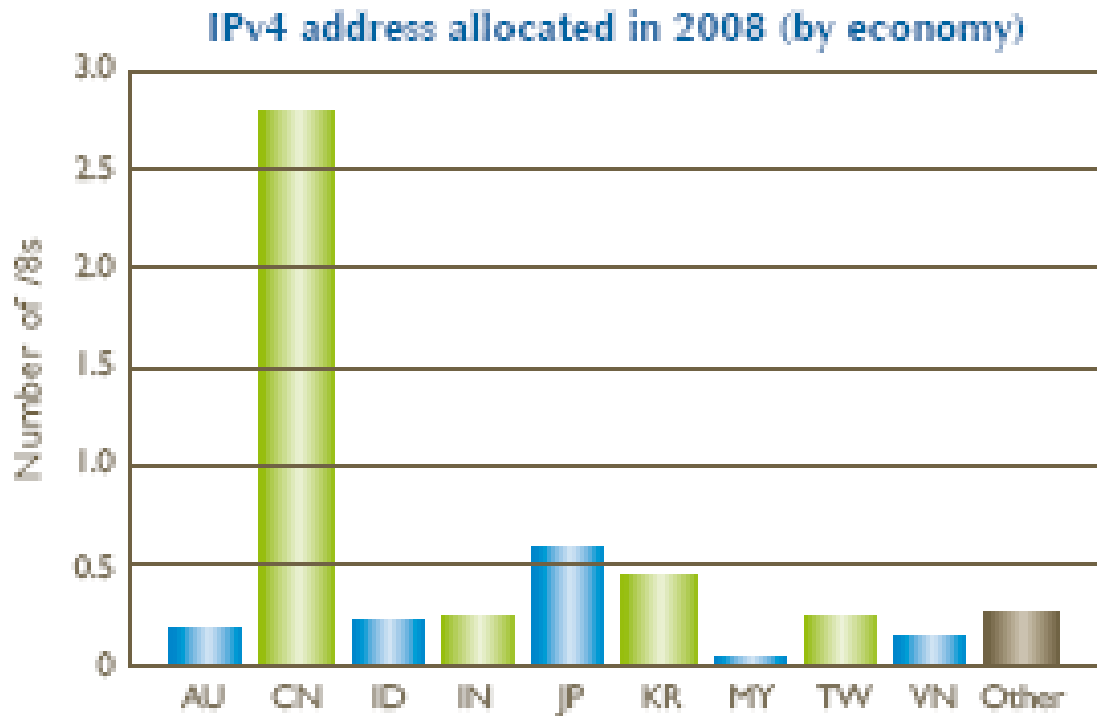
Exhaustion of the first RIR unallocated pool: **Sep-2012**

APNIC IPv4 Address Allocation

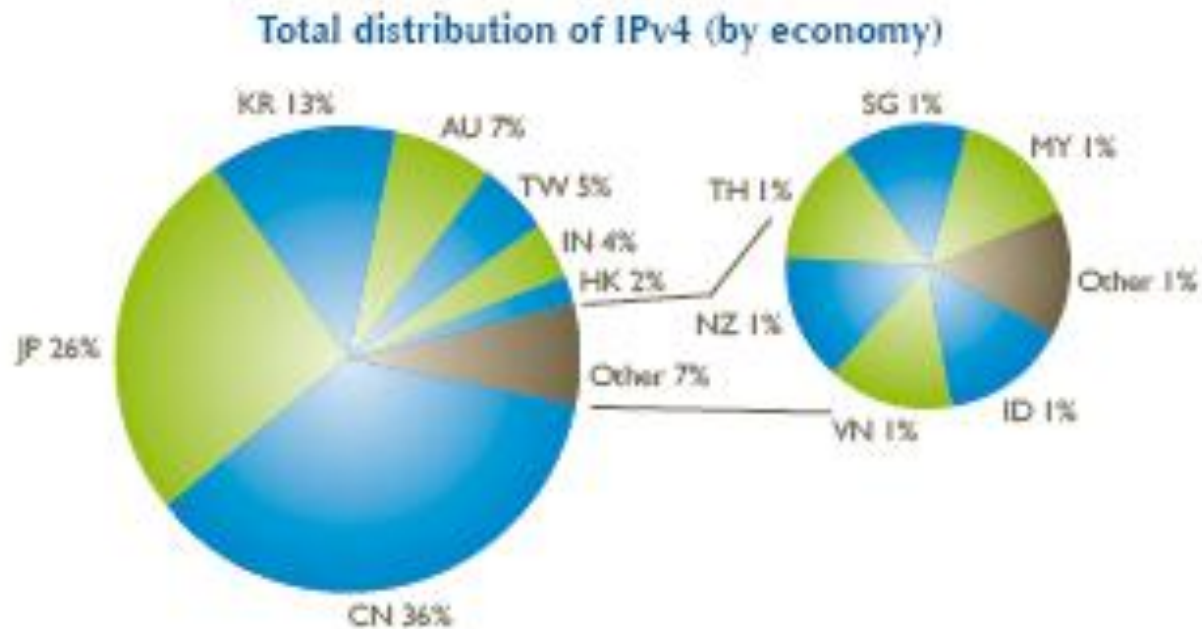
IPv4 Demand continued to grow in 2008

Year	IPv4 Allocated
2006	3.09 /8s
2007	4.18 /8s
2008	5.26 /8s

APNIC IPv4 Address Allocation in 2008

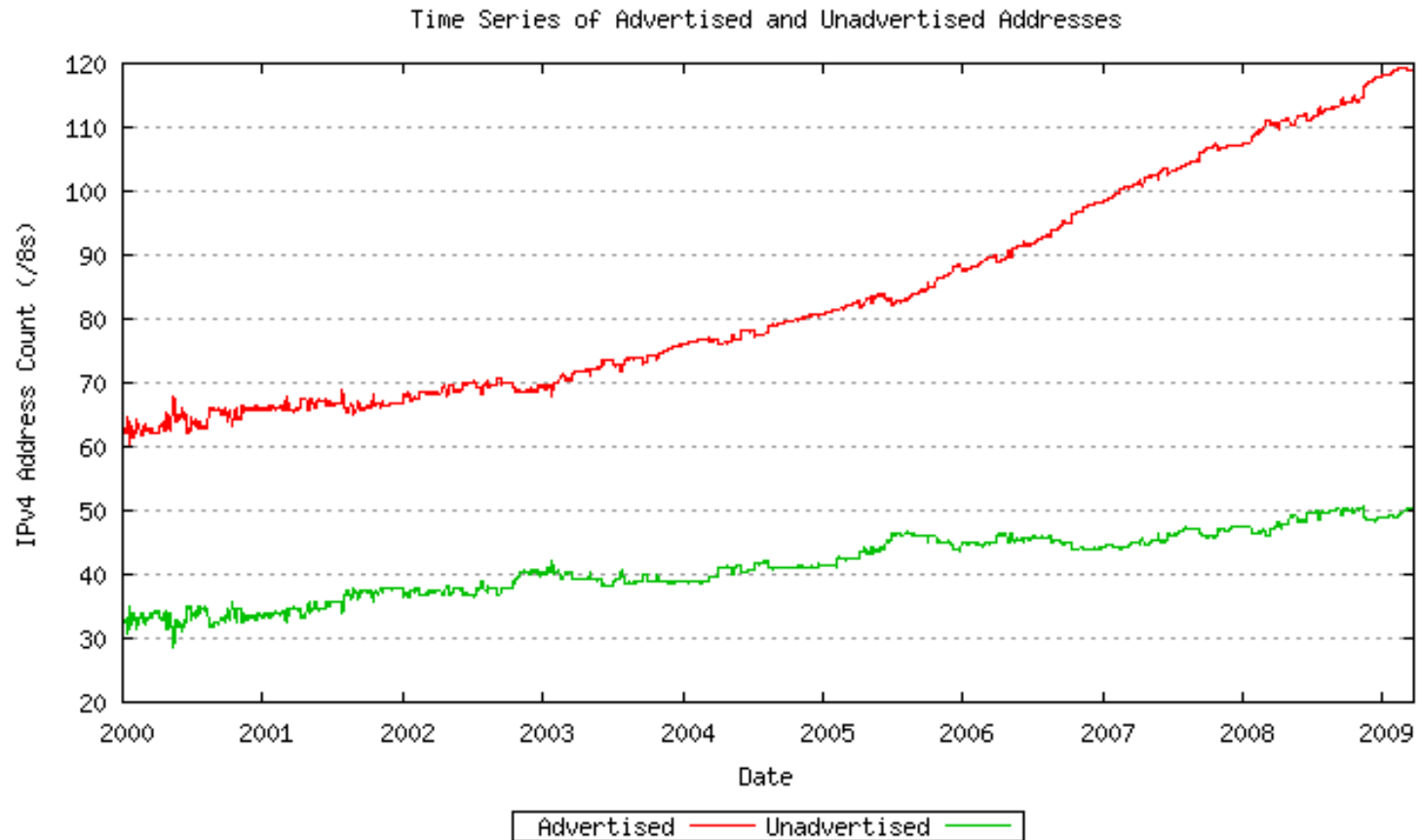


Total Distribution of IPv4 in APNIC



IPv4位址回收策略

Unadvertised Address



Reserved Address

- 36.086 /8 address blocks (RFC 3330)
 - 16 /8 blocks reserved for multicast (224~239)
 - 16 /8 blocks reserved for future use (240~255)
 - 1 /8 block (0.0.0.0/8) for local identification
 - 1 /8 block for loopback (127.0.0.0/8)
 - 1 /8 block for private use (10.0.0.0/8)
 - 172.16.0.0/12, 192.168.0.0/16
 - 1 /8 block for "public data networks" (14.0.0.0/8)
 - ...
-

國外IPv4位址回收策略 - IANA回收策略

- IANA (Internet Assigned Numbers Authority)的IPv4位址回收策略分成兩階段進行
 - 階段 I—回收IPv4位址空間
 - 轄下每個RIR(Regional Internet Registries)將以“季”為單位，來回收 /24或更大區塊的IPv4位址，並將回收的IPv4位址集中到IANA的“Recovered IPv4 Pool”中
 - 這個階段不進行位址分配
 - 階段 II--由IANA分配IPv4位址
 - IPv4位址分配的時間為3月1日和9月1日一年兩次分兩個期間來發放
 - 在分配的期間內，IANA將會決定分配數量的單位，以IPv4 Address Pool的1/10來計算並採用CIDR (power-of-2) 來切割區間，最小區間單位為/24
 - 當RIR向IANA提出分配IPv4 位址要求時，該要求分配的RIR所持有的IPv4位址必須少於IANA規劃分配單位的50%，並且該RIR在這次發放期間沒有被分配過為原則

國內IPv4位址回收策略 - TANet回收策略

■ 核發原則

□ 大專校院

- 於原使用IP之基礎下，擬增加申請IP數

- 專任教師*3+兼任教師*1+職員*2+學生*1.8

- 於配合更換為連續IP網段，擬增加申請IP數

- 專任教師*3+兼任教師*1+職員*2+學生*2

- 高中職以下：教師*3+職員*2+學生*0.3

- 各縣（市）立所屬學校，由縣（市）教育網路中心核發

- 本部附屬館所：依網路設施及管理需求核發

- 其它：依網路設施及管理需求，或因學術研究專案申請核可者，依審核結果核發

■ 回收原則

- 申請IPv4核發如併各機關或學校現有IP之重整計畫者，需於新IP網段核發後起計6個月內繳還原IP網段

Transfer Policy

- APNIC Prop-50
 - APNIC will process IPv4 address transfer requests ... subject to the following conditions:
 - 4.1 The minimum transfer size accepted will be a /24.
 - 4.4 APNIC is to maintain a public log of all transfers.
 - 4.5 Address transfers should be permitted between APNIC account holders and NIR members, if and when individual NIRs implement the transfer policy.
 - 4.6 Address transfers are permitted between APNIC account holders and other RIR account holders, following the policies of all the respective RIRs.
 - 4.7 This proposal to take effect as soon as the APNIC Secretariat can implement the mechanisms of the policy.

PROS

- Transfer allows correct recording of database
 - Mechanism is needed to re-use of the allocated but unused IPv4 address when IPv4 address runs out and IPv6 is not ready
 - Transfer encourages redistribution of excess addresses
 - ...
-

CONS

- Address transfer contradict to the current need based allocation policy
 - IPv4 address market
 - It attaches a potential 'value' to IP addresses, may encourage the transfer market.
 - It discriminates developing countries who have fewer IPv4 addresses
 - May lead to rapid growth of the routing table due to address de-aggregation problem
 - Current BGP routing table has more than 280,000 entries
-

New NAT Technologies

What's New

- Carrier grade NAT (CGN)
- If replacing customers' CPE is possible...
 - "A+P"
 - ID: 32-bit IPv4 address + 10 or 12-bit port number
 - Stateless Address Mapping
 - a global IPv4 address that is shared amongst several subscribers through a SAM-capable tunnel concentrator
 - Dual Stack Lite
 - a global IPv4 address that is shared amongst several subscribers through a CGN
 - NAT444
 - NAT twice: first using a NAT device in CPE and another NAT device in CGN

An IPv4 address shared amongst several subscribers.

NAT可能之問題(1/2)

- 對同時間的session數量有所限制
- NAT的透通性無法對所有應用軟體（尤其是端點到端點的通訊）。
- 目前2.5G GPRS 與3G R99/R4 由於IPv4 位址不足，仍採用NAT 技術，破壞了網路端點到端點的特性以及缺少固定IP、Always-on，限制了Mobile IP、VoIP 等應用的發展。

Limitation of NAT

Examples of # of concurrent sessions

Webpage	# of sessions
No operation	5~10
Yahoo top page	10~20
Google image search	30~60
Nico Nico Douga	50~80
OCN photo friend	170~200+
iTunes	230~270
iGoogle	80~100
Rakuten	50~60
Amazon	90
HMV	100
YouTube	90

Source: Apricot 2009, From IPv4 only to v4/v6 Dual Stack

NAT可能之問題(2/2)

- NAT 只會處理網路層與傳輸層的資訊，因此網路應用程式訊息中若帶有IP位址與通訊埠，在經過NAT之後就會發生錯誤。
- 通訊協定資料中如含有其IP address作為安全檢查的方式將需ALG的處理，如FTP、ICMP。新的協定ALG不一定知道要處理。
- 若在NAT內部架設Server如WEB Server、TP Server、E-mail Server、BBS等需藉由Port Forward的機制，增加設定的負擔。

IPv6

Transit to IPv6

- Technology ready?
 - Survey on IPv6 readiness
 - Transition or co-exist?
 - IPv4/IPv6 may co-exist for a long time (tens of years)
 - Experience of transition
 - Experience of IPv4/IPv6 co-existence
 - Standard procedure
 - IPv6 policies?
-

Q&A
