行政院及所屬各機關出國報告
（出國類別：考察）

考察「美國電信號碼資源管理及號碼可攜規劃與推動情形」出國報告書

出國人員：

服務機關	職稱	姓名
交通部電信總局	副局長	高凱聲
交通部電信總局	處長	王碧蓮
交通部電信總局	編審	王德威

出國地點：美國
出國期間：九十一年十二月十三日至二十日
報告日期：九十二年三月十八日

系統識別號:C09201129

公 務 出 國 報 告 提 要

頁數: 75　含附件: 是

報告名稱:

考察「美國電信號碼資源管理及號碼可攜規劃與推動情形」

主辦機關:

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高凱聲　交通部電信總局　副局長
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出國類別: 考察

出國地區: 美國

出國期間: 民國 91 年 12 月 13 日 -民國 92 年 12 月 20 日

報告日期: 民國 92 年 03 月 18 日

分類號/目: H6／電信　H6／電信

關鍵詞: 電信號碼,號碼可攜,資料庫查詢,集中式資料庫,ENUM

內容摘要: 本計畫之考察目的，主要在瞭解美國對電信號碼資源管理之做法並瞭解其對號碼可攜規劃與推動情形，此外亦想瞭解美國政府對最近興起之結合網際網路與電信網路的ENUM應用服務發展的看法。希望能透過與美國聯邦通信委員會(FCC)及美國商務部(DOC)直接面對面的討論，掌握第一手訊息。此外，因美國政府將電信號碼資源管理與號碼可攜集中式資料庫管理業務正式委託給美國NeuStar公司代爲執行，且NeuStar公司亦正式獲得網域名稱(.biz)及(.us)之核發權，故此行同時拜訪NeuStar公司，實地參訪其集中式資料庫之維運情況並與其公司人員進行討論，希望能確知美國在電信號碼資源管理與實施號碼可攜服務之實務狀況，同時更進一步希望能掌握未來電信服務與電信科技之發展趨勢，俾做爲我國相關政策、法規研擬及建立電信市場公平競爭環境之參考，以因應未來市場所需。

目　　錄

一、前言

本計畫之考察目的，主要在瞭解美國對電信號碼資源管理之做法並瞭解其對號碼可攜規劃與推動情形，此外亦想瞭解美國政府對最近興起之結合網際網路與電信網路的ENUM應用服務發展的看法。希望能透過與美國聯邦通信委員會(FCC)及美國商務部(DOC)直接面對面的討論，掌握第一手訊息。此外，因美國政府將電信號碼資源管理與號碼可攜集中式資料庫管理業務正式委託給美國 NeuStar 公司代為執行，且NeuStar 公司亦正式獲得網域名稱(.biz)及(.us)之核發權，故此行同時拜訪 NeuStar 公司，實地參訪其集中式資料庫之維運情況並與其公司人員進行討論，希望能確知美國在電信號碼資源管理與實施號碼可攜服務之實務狀況，同時更進一步希望能掌握未來電信服務與電信科技之發展趨勢，俾做為我國相關政策、法規研擬及建立電信市場公平競爭環境之參考，以因應未來市場所需。

本次考察係因應91年7月1日新修正電信法第二十條之一，授權電信總局對電信號碼資源進行委外管理與收費，並授權電信總局要求第一類電信事業提供號碼可攜服務後，為訂定相關管理辦法而從事之活動。考察期間自民國 91 年 12 月 13 日至 91 年 12 月 20 日止共 8 天。本次考察係新世紀資通之安排，透過美國 NeuStar 公司之連絡，分別參訪美國聯邦通信委員會(FCC)、美國商務部(DOC)及美國NeuStar公司。

二、拜訪行程

十二月十三日（五）啟程赴美國華盛頓特區

十二月十四日（六）資料整理、調整時差

十二月十五日（日）行前事務協調與 NeuStar 公司人員進行初步會談

十二月十六日（一）參訪美國聯邦通信委員會(FCC)

參訪 NeuStar 公司位於 Sterling, Virginia 的集中式資料庫管理維運中心並聽取簡報

十二月十七日（二）參訪美國商務部(DOC)

參訪 NeuStar 公司位於華盛頓特區之總部並聽取簡報

十二月十八日（三）回程搭機返國

十二月二十日（五）返抵國門

三、考察內容紀要

（一）美國號碼資源管理之歷史沿革及現況

- 北美使用之編碼計畫(NANP：North American Numbering Plan)創於 1947 年，該編碼計畫係供北美共 19 個國家共同使用。換言之，美國係和其他北美國家共享(E.164 格式)電信號碼資源。
- 北美編碼計畫之格式如下：

NPA + NXX + XXXX

NPA：Numbering Plan Area code

NXX：Central Office code (N=2~9，X=0~9)

XXXX：Station number

各國分享號碼資源時，係以 NPA 為核發單位。

- 美國國內之電信號碼資源管理原由 AT&T 負責，但在 1984 年 AT&T 被 FCC 要求分割後，電信號碼資源管理分為兩部分。
  1. 關於長途部分交由新設立之 Bellcore(現已改名為 Telcordia Technologies)負責，其內容為：
     (1)視美國國內電話號碼資源需求，調整或啟用 NPA 號碼區塊。
     (2)核配受話方付費(800 字頭)下之號碼容量
     (3)核發業者識別碼(CIC)給各長途業者
     (4)核發諮詢費率服務(900 字頭)下之號碼容量
     (5)每年進行 NPA(各州)及 NPNA(美國國內)的號碼容量需求預估
  2. 關於市內部分交由和當地之市話市場主導者負責，其內容為局碼之分配。
- 為解決局碼分配公正性之疑慮，FCC 應各方要求，於 1994 年公布了局碼核配指導原則，要求各市話市場主導者於核配局碼時須依照上述原則進行。
- FCC 於 1992 年起，即對各電信業者進行意見調查，探詢各業者對將電信號碼資源管理移交中立第三者統一管理以維持公正客觀競爭環境之必要性。

- FCC 於 1997 年起，創立北美電信號碼協調處(North American Numbering Council)，該協調處依據美國聯邦諮詢委員會法所訂定之建議案(Recommendation)來解決電信號碼於各電信業者間所引起之爭議並發展美國之電信號碼管理政策。該協調處(NANC)被授權推薦一個中立之管理者(北美電信號碼計畫管理者 NANPA：North American Numbering Plan Administrator)來統籌管理美國之局碼及區域號碼，而各電信業者須按營收大小比例，攤分管理者(NANPA)所需維運之經費。
- FCC 於 1997 年經由連續比價(competitive bidding)之方式，選擇了洛克希德馬汀(Lockheed Martin)公司做為電信號碼資源管理者(NANPA)，同時簽訂了五年的合約。後因 Lockheed Martin 是一家國防工業之公司，為使管理者業務單純化及維持客觀中立形象，FCC 要求 Lockheed Martin 公司將從事該項電信號碼資源管理業務之部門獨立出來，於是 1999 年後 NeuSatr 公司成立，繼續原有之電信號碼資源管理任務。
- FCC 於選出電信號碼資源管理者(NANPA)後，即要求原負責管理電信號碼資源之業者(即 Bellcore 及各市話市場主導者)於 18 個月內，正式將管理權移轉給 NANPA.
- 美國電信號碼資源管理者(NANPA)現為 NeuStar，其主要任務如下：
  1. 做為一個公平客觀之電信號碼資源管理者
  2. 依 FCC 及電信業界之指導原則，公正客觀地核配電信號碼資源。

3. 依據電信號碼資源使用率與需求(NRUF：Number Resource Utilization/Forecast)報告或其他資訊，每年須提出一次之電信號碼資源充裕度報告。

4. 維護電信號碼資源網站，將各電信號碼資源之分配狀況、統計資料等公告大眾，同時至少應每週更新該公布資料一次。

5. 對監督管理者工作小組(NOWG：NANPA Oversight Working Group)提出評核報告或其他重要議題之報告。

6. 對電信號碼資源之申請方便性、一致性、核配發布、會議通知等事項，須維持最高品質之服務。

7. 和政府各管理機關保持聯繫。

8. 參與電信界各類有關電信號碼格式或使用方式等相關會議。例如 INC(Industry Numbering Committee：電信業界之電信號碼委員會)、NANC(北美電信號碼資源協調會)等。

（二）美國號碼可攜服務之歷史沿革及現況

- 由於民眾對維持用戶號碼之要求及加速業者間之公平競爭，1994 年起，美國電信業界開始認真地思索提供號碼可攜之可行性。
- 1995 年 5 月，MCI 及 DSC Communications、Tandem Comuters、Siemens Telecom Networks 等公司，於紐約以業者可攜碼(CPC：Carrier Portability Code)技術做了一次小型實際測試，證明號碼可攜確實是可行的。
- 1995 年 7 月 FCC 發出公告徵請電信業界提出如何進行

號碼可攜之建議書，並請業界對各種號碼可攜之政策性議題或技術方案提供評論。

- 1995 至 1996 年間，數個州政府管理當局就自行開始進行測試，而其中最為人所稱道的是伊利諾商務委員會(ICC：Illinois Commerce Commission)所進行之實驗。
- 1996 年 2 月伊利諾商務委員會(ICC)在芝加哥進行實驗，廣邀各設備商提出經濟有效之完整號碼可攜解決方案，並邀請主要電信業者(Ameritech、AT&T Corp.、TCG、MCT Metro、Sprint/Centel 及 MFS(WorldCom))共組評選委員會，該評選委員會做成兩項重要結論如下：
  1. 評選委員會決定採 AT&T/Lucent 所提出之 Location Routing Number(LRN)為完整解決方案。【日後為各州所採用】
  2. 訂定"號碼可攜服務所使用之交換與信號規格需求(Generic Switching & Signaling Requirements for Number Portability)【成為電信業界之實質標準】。
- 1996 年美國新修訂電信法中，已強制要求各市話業者須提供號碼可攜服務。
- 市話業者被要求須在 1997 年 10 月 1 日起至 1998 年 12 月 31 日之時段內，依五階段規劃，於全美 100 個最大的都市中(NSAs：Metropolitan Statistical Areas)提供號碼可攜服務。
- 在 1999 年 1 月 1 日後，全美 100 大都市外之其他地區，亦需於該地區任一市話業者提出實施號碼可攜服務要求後的六個月內實施號碼可攜服務。

- 行動電話業者必須於1998年12月31日提供行動用戶號碼可攜，且自1999年6月30日起，提供市話及行動間之跨業務號碼可攜服務。【註:本項要求後來已延後實施】
- 1996年FCC為避免壟斷，將全美分為七大區，由各大區內之電信業者組成評選委員會，選擇該區之號碼可攜資料庫管理者。
- 1997年七大區之號碼可攜資料庫管理者評選結果為，洛克希德馬汀(LM-IMS：Lockheed Martin；改組後改名為NeuStar)獲選為 Midwest、Mid-Atlantic、Northeast及Southwest四大區之管理者，而Perot Systems公司獲選為Southeast、Western及West Coast三大區之管理者。
- Midwest、Mid-Atlantic及Northeast區分別於1997年9月26日、10月30日及11月30日成功完成號碼可攜資料庫，但Perot System公司所負責的三大區始終沒進展，信號溝通一直出問題，於是在1998年2月該三大區之電信業者正式終止與Perot System公司之委託關係，改由洛克希德馬汀擔任此三大區之號碼可攜資料庫管理者，因此，目前全美之號碼可攜資料庫管理者就完全由洛克希德馬汀公司一手包辦。
- 1998年5月加拿大亦終止其與Perot System公司之委託關係，改由洛克希德馬汀擔任加拿大號碼可攜資料庫管理者。
- 因Lockheed Martin是一家國防工業之公司，為使管理者業務單純化及維持客觀中立形象，FCC要求Lockheed

Martin 公司將從事該項號碼可攜資料庫管理業務之部門獨立出來，於是 1999 年 12 月 NeuSatr 公司成立繼續 1997 年受委託擔任號碼可攜資料庫管理者之責任。

- 美國市話號碼可攜服務推行順利，但行動號碼可攜服務卻因技術上之因難，至今尚未實施。行動號碼可攜實施日期由原要求之 1999 年 6 月 30 日延至 2000 年 3 月 31 日，後又延至 2002 年 11 月 24 日，後再次延至 2003 年 11 月 24 日。

（三）美國 ENUM 之發展

- FCC 表示他們對 ENUM 也很關心，但有關網際網路之業務並非他們主管，因此不便表示意見。
- DOC(美國商務部)表示，美國對網際網路之發展一向採低度管制之精神，因此對 ENUM 之發展樂見其成，但不宜主導。【註：據 92 年 2 月 18 日電子時報綜合外電報導，美國布希政府誓言支持整合電話號碼與電子郵件位址的提案，讓未來個人通訊更加便利。該項建議是由美國商務部提出，建議美國政府參加國家電子編號系統(Emerging Electronics Numbering System；ENUM)，將境內民眾的電話號碼與電子郵件位址整合為一，簡化個人通訊時所需的繁瑣過程。】
- NeuStar 公司正積極研究 ENUM 的商業應用，並參與國際上 ENUM 論壇(ENUM Forum)討論，以期能早一步掌握商機，甚或制定規格。ENUM 目前在應用層次上可分為 End User ENUM、Carrier ENUM 及 Private ENUM 三大類。而應用案例如 VoIP(網路電話)、NP(號碼可攜服

務)、MMS 訊息傳遞等，幾乎現今電信網路與網際網路上之重要服務類別都是 ENUM 的應用研究對象。展望未來，配合 Ipv6 之推展，ENUM 很可能變成結合電信網路與網際網路之關鍵技術。

（四）NeuStar 公司之營運與未來發展

- NeuStar 公司將電信號碼資源管理資料庫和號碼可攜資料庫合而為一，除可方便管理減少成本外，更因資料庫整合而可藉此發展各項新穎加值服務。
- NeuStar 公司為維持資料庫之安全運作，因此在伊利諾州之芝加哥及維吉尼亞州之 Sterling 兩地都建置了一模一樣的資料庫，原以芝加哥為主系統 Sterling 為備援系統，後因芝加哥工作成本較高，已改為以 Sterling 為主系統之模式。
- NeuStar 擔任電信號碼資源管理之收入每年平均約為伍佰零陸拾萬(5.06M)美元。至於有關號碼可攜服務集中式資料庫管理者方面之收入則未透露。
- NeuStar 認為以電腦之角度來看，文字和數字並無不同，亦即加值服務必定會走向電信網路與網際網路結合的方向。NeuStar 認為現今已有多項此類運用，如 VoIP(在網際網路上使用電話功能)、在行動網路上收發電子郵件等，但目前仍只算是聯合階段(combination)(亦即只能於同一時間使用 Internet 或 telephone 功能)，以後會是結合階段(convergence) (亦即可同時使用 Internet 及 telephone 功能)。其中集中式資料庫、號碼可攜與 ENUM 會是重要的三個因素。

- 未來 NeuStar 之發展將以集中式資料庫為核心，發展應用軟體，研發各項加值服務。在號碼管理部分，結合號碼可攜服務功能，希望日後核配電信號碼資源時能以每一電信號碼為一個單位【註：我國目前行動電話號碼是以 10 萬號為一核配單位、市內電話是以 1 萬號為一核配單位】；在號碼可攜部分，目前用戶申請號碼可攜服務可以在 2 個小時內完成，未來的目標是 2 分鐘；在加值服務部分，NeuStar 正推銷數位認證(Digital Identity)希望能廣泛運用於電子商務上。此外，NeuStar 亦全力推銷其所代理之.biz 及.us 網域名稱之核發業務(該公司亦獲得大陸.cn 網域名稱之海外代理權)。將來會將網域名稱註冊登記資料庫(who is)、IP 位址紀錄與電信號碼資源資料庫、號碼可攜資料庫等予以結合，研發出如 ENUM、Digital Identity 等更多樣化的加值服務。

四、考察心得建議

此行參訪之原意在探討如何進行電信號碼資源管理及如何推動號碼可攜服務，但卻發現這兩項管理機制僅是美國正朝向電信科技與網際網路結合趨勢下之必備要素，真正之價值是在適應未來科技大融合的情況及創新層出不窮的電信加值服務。為提升我國之國家競爭力，建構一個能讓資訊與電信產業彼此合作之平台，應儘速下列事項之推動。

（一）資料庫查詢能力

（二）集中式資料庫

（三）引進國外先進技術及經驗

（四）電信號碼資源委外管理

（五）構思集中式資料庫未來管理機制及應用

推動各項事項之理由如下：

（一）資料庫查詢能力

號碼可攜服務之原意在促進電信市場之公平有效競爭及維護消費者之權益，如果眼光僅止於此，相信各電信業者會依其目前市場地位各有考量，或歡迎或抗拒，而電信總局推動之決心也會因而受到影響。但因實施號碼可攜服務時必須要配合實施電信發話網路之資料庫查詢，而資料庫查詢能力正是邁向新世代電信服務之必備能力，因此構建一個各電信業者都能彼此互通的資料庫查詢規格平台，才是電信總局推動號碼可攜服務之最大價值。

目前國內多數電信業者之資料庫查詢規格是採 IN(智慧型網路)或 SRF(信號中繼功能；註：GSM 網路使用)，但該二種技術規格為適應未來新服務之發展，因此在國際電信聯合會(ITU)設計規格時，格式中都存在許多可選用參數(optional parameter)以增加其靈活性，但因各電信大廠都獨立在開發新功能、新服務，致使彼此所選用參數之安排不盡相同，而各大廠或為專利權，或為主導權，又互不讓步，故對不同電信設備商間之新電信服務溝通產生實質之困難。現

在正好藉著號碼可攜資料庫查詢之規格討論，讓電信業者能回頭要求電信設備商提供我國所想要之細部規格，使將來各電信業者間之信號溝通得以順利進行。

（二）集中式資料庫

就號碼可攜服務之推動來看，資料庫查詢能力是必備的，但就資料庫架構方面，以技術上來說，集中式資料庫與分散式資料庫皆可。惟參考美國推動號碼可攜服務之經驗及觀察現今技術與服務之發展趨勢，採集中式資料庫應是最佳選擇，分析如下：

1. 管理之有效性

美國在推動號碼可攜服務資料庫時，首先遇到的是各電信業者本位主義心理所產生之抗拒。各電信業者皆認為用戶資料是其重要資產，不能把他交出去。但業者數目過多，每家業者都希望自己的設備不要做修正，要別家業者修正來配合自己，因此要透過電信業者協商談出結果的可能性幾乎是零。於是美國改採各電信業者要將號碼資料庫委託中立第三者管理之模式。為防止壟斷情況出現，美國初期還刻意將全美分為幾大區，而每區都各選其中立第三者之模式來進行。但在多年實驗後發現，即使是中立的第三者，彼此間還是會有本位主義的存在，技術上成熟度不一，溝通不協調的狀況履履發生，所以最終才會採行集中式資料庫。美國過去遇到的情況，相信我國也不會少，但為儘速建構溝通平台，以提升我國各電信產業對未來電信網路與網際網路結合趨勢下之國際競爭力，我

國實無太多時間能像美國花七年的時間進行號碼可攜技術架構之實驗，爰逕行選擇集中式資料庫之架構，減少行政溝通之程序。此外，採集中式資料在網路維護、資料傳遞安全性方面都較易保證品質。

2.服務之效率與經濟性

以目前服務軟體趨勢之發展，都朝向資料庫整合，流程整合之方向。譬如在電子商務方面，軟體服務平台正努力將企業之企業資源規劃系統(ERP)、客戶關係管理系統(CRM)、訂單流程、物流派遣等多項資料庫之整合，以求得運作之效率性、經濟性及一致性，所以集中式資料庫較分散式資料庫之卓越性應是可推論得知的。事實上根據 NeuStar 透露，他們在美國評選時所以會獲各電信業者青睞之原因，在於他們的報價最低但卻能提供多樣化的服務與最佳的服務品質保證。這其中最大的關鍵，就在於他們整合各種資料庫之能力。除了美國之外，加拿大也委託他們進行電信號碼可攜集中式資料庫之管理。而歐洲八個國家(英國、法國、德國等)亦委託 NeuStar 為他們共建一個電信號碼資源之集中式資料庫，顯見集中式資料庫之發展潛力。

（三）引進國外先進技術及經驗

即便已對推動號碼可攜(資料庫查詢能力)及集中式資料庫之方向有所定見，但這其中所牽涉的議題擬定、規格討論、作業流程、費率分攤等實務問題，

皆非無經驗之我國可以在短期內完成的。為儘速電信與資訊交流平台之建立，我們應該大力藉助國外之先進技術及經驗。如何吸引國外之廠家來此貢獻心力，是值得探討的議題。

（四）電信號碼資源委外管理

基於電信網路與網際網路結合趨勢下，第二類電信業者未來有向電信總局直接申請電信號碼之需求，電信號碼資源之核配必須走向小量且快速的能力，特別是在多家電信業者共同申請相同數字之好電信號碼時，甚至還需要發展線上拍賣之機制。此外，目前熱烈討論之 ENUM 應用服務，其中心資源即是電信號碼，亦即電信號碼資源資料庫屆時要能與他資料庫結合或提供各需要業者動態查詢之能力。此種技術能力與管理之效率性，皆恐非行政機關所能負擔。因此，委外管理，做好監督工作，似是電信總局較宜採行之方式。

（五）構思集中式資料庫未來管理機制及應用

鑑於電信網路與網際網路結合之趨勢，未來集中式資料庫所能衍生之電信加值服務實已無法想像，而掌握集中式資料庫可能就掌握了未來的商機。因此推行號碼可攜服務之初期，雖囑意由中立第三者進行管理，但日後如何確保集中式資料庫之利益能為所有電信業者甚或資訊業者共享，仍有待不斷地觀察國外發展態式及與國內各相關業者之溝通。

五、結語

本次參訪瞭解了美國政府及業者對電信號碼管理與號碼可攜服務之推動沿革及實施現況，同時亦分享了該國對未來電信發展之趨勢的看法，實不虛此行。未來應更加速我國號碼可攜相關機制(資料庫查詢及集中式資料庫)與電信號碼資源資料庫管理之作業，以使我國電信及資訊業能於下一波科技趨勢中掌握先機。

感謝新世紀資通及美國 NeuStar 公司代為接洽並安排相關參訪行程，特此致謝。

六、附件

North American Numbering Plan And Its Administration

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The North American Numbering Plan (NANP)

- The NANP serves most of North America
  - Includes the US, Canada, Bermuda, and 16 Caribbean islands.
  - Mexico, Cuba, and Caribbean islands with strong European ties use separate country codes
  - The US and Canada use 99% of the assigned NANP numbering resources
- NANP numbers are 10 digits in length
  - 3-digit area code
  - 3-digit central office code
  - 4-digit line number

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More about the NANP

- NANP telephone number summary…
  - 324 area codes are in service (100 of them added during NeuStar's tenure as NANPA)
  - 127,000 central office codes are assigned to service providers
  - Overall telephone number utilization rate in the US is 39.7% and increasing
  - 480 million numbers are assigned to customers

NANPA and What It Does

- What does NANPA do?
  - Administers numbering plan resources
  - Coordinates area code relief planning in the US
  - Collects utilization and forecast data in the US
  - Advises the industry and regulators on numbering issues
- NANPA characteristics
  - Non-governmental entity
  - Selected through a competitive bidding process
  - Does not make policy
  - Must remain absolutely neutral
- NeuStar is Serving a 5-Year Term as NANPA

NeuStar NANPA Accomplishments

- Consolidated 16 separate administrations into one
- Built and introduced a system for tracking number utilization and forecasts
- Processed more than 150,000 resource applications
- Coordinated 132 area code relief activities
- Led more than 1,000 public meetings
- Processed 12,000 service provider forecast submissions in 2002
- Accomplished all of the above with no neutrality complaints to the FCC

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Interesting Questions

- Will North America continue to have an integrated numbering plan?
- Will the NANP move towards a closed dialing plan?
- When will the NANP exhaust?

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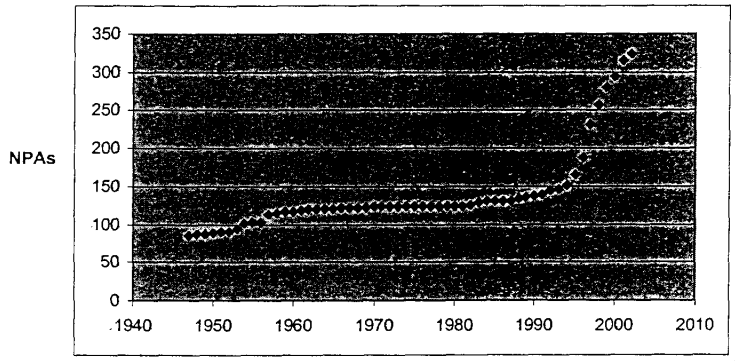
Area Codes in Service



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NANPA Web Site

- NeuStar maintains a very large web site at www.nanpa.com. It contains…
  - Listings of all assigned resources
  - Area code maps
  - Area code relief plans
  - Links to related sites
  - Contact information

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Number Portability in the U.S.

Marcel Champagne
NeuStar, Inc.
December 16, 2002

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Outline

- Number Portability History (USA & Canada)
- NP Technologies
- NP Administration and Cost Recovery
- NP Current Status
- Future of NP

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NP History
(U.S.A. & Canada)

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NP Historical Timeline

- *Late 1994* - The telecommunications industry began to seriously investigate methods of providing true LNP.
- *May 1995* - MCI, with support from DSC Communications, Nortel, Tandem Computers, and Siemens Telecom Networks, demonstrated the Carrier Portability Code (CPC) to the FCC via a live test in NY, proving that true LNP was indeed technically feasible.
- *July 13, 1995* - FCC's the Notice of Proposed Rulemaking (the "NPRM", FCC 95-116)

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NP Historical Timeline (2)

- *July 1995* - Illinois Commerce Commission (ICC) took the lead at the first state to address LNP
  - Four different LNP architectures reviewed by ICC LNP workshop
- *November 1995* - ICC LNP Workshop selected AT&T's Location Routing Number (LRN) solution for LNP
- *November 16, 1995* - All switch vendors (AT&T Networks Systems (now Lucent), Nortel, Siemens and Ericsson) present in the main ICC LNP workshop indicated that they could provide LNP software capabilities based on ICC specifications by 2Q97

NP Historical Timeline (3)

- *Late 1995 and 1996* - LNP implementation in Chicago initially set for 2Q97
  - FCC Order called for LNP testing during 3Q97, which changed full LNP implementation date to 4Q97
- *1995 and 1996* - Several other state regulatory bodies also began the process of officially selecting the architecture to be used for LNP in their respective states
  - They also selected the LRN solution
  - ICC LNP "Generic Switching & Signaling Requirements for Number Portability" has become the *de facto* industry standards

NP Historical Timeline (4)

- ***February 1996*** **- Telecommunications Act of 1996 (the "1996 Act", Pub. L. No. 104-104 Stat. 56 (1996))**
  - An original bill to provide for a pro-competitive, de-regulatory national policy framework designed to accelerate rapidly private sector deployment of advanced telecommunications and information technologies and services to all Americans by opening all telecommunications markets to competition, and for other purposes
  - Has the potential to change the way we work, live and learn. Will affect telephone service -- local and long distance, cable programming and other video services, broadcast services and services provided to schools
  - *The Mandate* -- new Section 251 (b) (2) of the Communications Act of 1934, as added by the 1996 Act, directed each local exchange provider "to provide, to the extent technically feasible, number portability in accordance with the requirements prescribed by the Commission"
  - *The Definition of Number Portability* -- "the ability of users of telecommunications services to retain, at the same location, existing telecommunications numbers without impairment of quality, reliability or convenience when switching from one telecommunications carrier to another"

NP Historical Timeline (5)

- ***February 6, 1996*** **- ICC NPAC/SMS Request for Proposal (RFP)**
  - Invited prospective vendors to submit a total solution and associated firm pricing proposal to provide a Number Portability Administration Center and Service management System (NPAC/SMS) to support the implementation of Local Number Portability in the Chicago LATA 358 in the state of Illinois
  - The Selection Committee consisted of Ameritech, AT&T Corp., TCG, MCI Metro, Sprint/Centel and MFS (WorldCom) - the Limited Liability Company (LLC) members
  - Defined the LNP architecture (LRN method), the functions of the SMS, and the management and integration role of NPAC
  - Defined the business process flows indicating how the NPAC and NPAC/SMS are used in the various business processes associated with number portability
  - Defined two interfaces to the NPAC/SMS based on CMIP protocol: the service provider's Service Order Activation (SOA), and the Local Service Management System (LSMS)
  - Defined specific requirements for security, audit administration, report management, reliability, availability, performance and capacity
  - Defined high-level billing and resource accounting functionality

NP Historical Timeline (6)

- ***June 27, 1996*** **- FCC's First Report and Order and Further Notice of Proposed Rulemaking (FCC 96-286, the "First Report & Order")**
  - The first concrete national effort to fashion rules and framework for the development and implementation of effectively competitive local telephone markets, provisioned by the "1996 Act"
  - All LECs must begin to implement a long-term database method for service provider portability in the 100 largest Metropolitan Statistical Areas (MSAs) no later than October 1, 1997, and to complete deployment in those MSAs by December 31, 1998; over five phases
  - Beginning January 1, 1999, all LECs (even outside of top 100 MSAs) must make LNP available within six months after a specific request by another telecommunications carriers in areas in which that telecommunications carriers is operating or plans to operate
  - Wireless (CMRS) must have the capability of delivering calls from their networks to ported numbers anywhere in the country by December 31, 1998 and service provider portability by June 30, 1999
  - North American Numbering Council is responsible for deciding the number of NPAC databases and where they need to reside, however, states may opt out of regional NPAC

NP Historical Timeline (7)

- FCC Minimum performance criteria for LNP
  1. support existing network services, features and capabilities
  2. efficiently use numbering resources
  3. not require end users to change their telecommunications numbers
  4. not require telecommunications carriers to rely on databases, other network facilities, or services provided by other telecommunications carriers in order to route calls to proper termination point
  5. not result in unreasonable degradation in service quality or network reliability when implemented
  6. not result in any degradation of service quality or network reliability when customers switch carriers
  7. not result in a carrier having a proprietary interest
  8. be able to accommodate location and service portability in the future
  9. have no significant adverse impact outside areas where number portability is deployed
- No technology solution was mandated, but suggested that LRN was the only technology available today that meets the outlined criteria, and the industry had coalesced around the LRN solution
- Directed the carriers in the Illinois LNP Workshop to conduct an LNP field test no later than August 31, 1997

NP Historical Timeline (8)

- *1996* - Lockheed Martin - Communications Industry Services (LM-CIS) selected competitively as first LNPA/NPAC in Illinois (Midwest)
- *March 6, 1997* - FCC's First Memorandum Opinion and Order on Reconsideration (FCC 97-74, the "First Reconsideration Order")
  - Extended the end dates for Phase I of the deployment schedule by three months, and for Phase II by 45 days
  - Recommended LRN method as the long-term LNP solution, Query on Release (QoR) is not permitted
  - Removed point #4 out of the "minimum criteria" list based on its impracticality

NP Historical Timeline (9)

- *May 19, 1997* - LM-CIS NPAC/SMS started turn-up testing with AT&T's SOA/LSMS over the CMIP mechanized interface
- *August 11, 1997* - Midwest Region started LNP-LRN FCC Field Test (Inter-company LNP Testing), the test was successfully completed on September 26, 1997
- *1997* - LM-CIS selected competitively as the LNPA/NPAC in Mid-Atlantic, Northeast, and Southwest Regions

NP Historical Timeline (10)

- *August 14, 1997* - FCC's Second Report and Order (FCC 97-289, the "Second Order & Report")
  - Established seven regional number portability databases coinciding with the boundaries of the seven original BOC regions
  - LM-IMS (Midwest, Mid-Atlantic, Southwest, Northeast) and Perot (Western, West Coast, Southeast) will be the administrators of those seven regional NPACs
  - Required the carrier immediately preceding the terminating local exchange carrier (N-1 carrier) be responsible for ensuring that number portability database are queried
- *October 30, 1997* - Mid-Atlantic Region went live and made LNP available to its commercial and residential customers
- *November 30, 1997* - Northeast Region went live and ready for commercial porting

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NP Historical Timeline (11)

- *January 9, 1998* - MCI activated 200 live telephone numbers for its commercial customer in the Northeast Region
- *February 1998* - LLCs in Southeast, Western and West Coast regions terminated contracts with Perot Systems, Inc., the originally selected NPAC administrator in those regions

  LM-CIS took over those three regions and became the only NPAC/SMS vendor in US
- *May 1998* - Canadian Consortium terminated its NPAC/SMS contract with Perot and signed with LM-CIS
- *December 1999* - LM-CIS became NeuStar, Inc.

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Wireless NP in the U.S.

- **NP between wireline and wireless carriers is possible because**
  - Same numbering scheme
  - Called party pays the air time
- **Major implementation issues**
  - MIN/MDN separation (for CDMA & TDMA networks)
  - Roaming partners outside 100 MSAs must support MIN/MDN separation
- **Wireless SPs got three extensions from the original date**
  - 6/30/99 to 3/31/00
  - Then to 11/24/02
  - currently to 11/24/03
- **Wireless "Number Pooling" adopted 11/24/02**

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Number Portability Technologies

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Service Provider NP Schemes

- All Call Query (ACQ)
- Query on Release (QoR)
- Dropback
- Onward Routing (OR)

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Comparisons of Four Schemes

	ACQ	QoR	Dropback	OR
Involving donor network	no	yes	yes	yes
Physical call segment	one	one	one	two
Transmission Efficiency	Best	Less	Less	Least
Database	Centralized (all ported numbers)	Centralized (all ported numbers)	Local/internal (only ported out numbers)	Local/internal (only ported out numbers)

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LRN/ACQ Scheme

- In US, a switch has at least one Location Routing Number (e.g., 571-434-0000) whose NPA+NXX is one of the assigned NPA+NXX of the switch.
- Portability limited to rate center/district boundaries of the incumbent LEC
- When a TN is ported into a switch, the new SP provides the TN and the switch's LRN to the NPAC
- The NPAC then broadcasts the information via LSMS interface
- The ported TN information is loaded into the NPDBs that handle real-time queries for call processing

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LRN/ACQ Scheme (2)

- When routing a call, a switch performs a NPDB dip and
  - Puts the LRN in the Called Party Number parameter
    - The LRN is used by the network to route the call
  - Puts the original dialed TN in the Generic Address parameter
    - The original dialed TN is used by the terminating switch to locate the loop
  - Sets the Ported Number Translation Indicator bit of the Forward Call Indicator parameter of the ISUP Initial Address Message
    - The PNTI bit prevents additional NPDB dips being performed
- Determination on when to do the database query controlled by SP switches

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NP Administration and Cost Recovery

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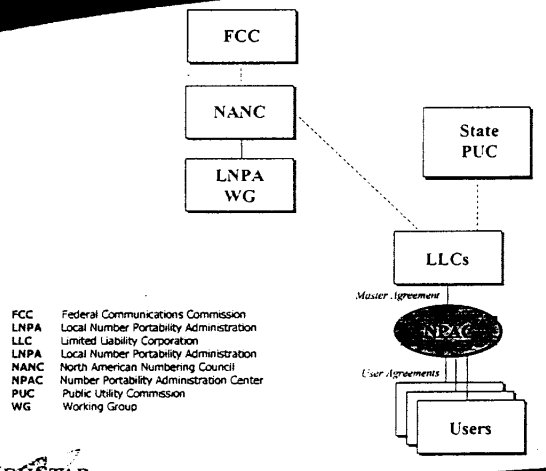
NPAC Governance Model



Enforcement

Policy Enactment

Policy/Standards Formation

Contract/Procurement Administration

Neutral Third Party Services

NAPC Users

FCC	Federal Communications Commission
LNPA	Local Number Portability Administration
LLC	Limited Liability Corporation
LNPA	Local Number Portability Administration
NANC	North American Numbering Council
NPAC	Number Portability Administration Center
PUC	Public Utility Commission
WG	Working Group

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NPAC Regions

NPAC Regions	Specific States
Region #1: West	Washington, Oregon, Montana, Wyoming, N. Dakota, S. Dakota, Minnesota, Iowa, Nebraska, Colorado, Utah, Arizona, New Mexico, Idaho and Alaska
Region #2: West Coast	California, Nevada and Hawaii
Region#3: Mid-West	Illinois, Wisconsin, Indiana, Michigan and Ohio
Region#4: Southeast	Florida, Georgia, N. Carolina, S. Carolina, Tennessee, Kentucky, Alabama, Mississippi and Louisiana
Region#5: Mid-Atlantic	New Jersey, Pennsylvania, Delaware, Maryland, W. Virginia, Virginia and Washington, D.C.
Region#6: Southwest	Texas, Oklahoma, Kansas, Arkansas and Missouri
Region#7: Northeast	Vermont, New Hampshire, Maine, New York, Connecticut, Rhode Island and Massachusetts
Region#8: Canada	

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North American NPAC Service Overview

- **NPAC designed to support various types of number portability**
  - Service provider, location, and service portability
- **Turnkey service solution; 7x24 operations**
- **"Golden" system and database for the service providers (SPs)**
- **Coordinates the "porting" of TNs between SPs**
  - Create, modify, activate, cancel, conflict and disconnect subscriptions
- **Downloads routing (LRN) changes to SP networks**

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North American NPAC Service Overview (2)

- **Developed according to standardized Functional Requirements Specifications (FRS) and Inter-operable Interface Specifications (IIS)**
- **FRS and IIS maintained in public domain**
- **Administered by neutral third party**
  - Mandated by regulators and SPs
  - Fix-term contract; open bidding at contract renew time

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NPAC Main Functions

- **Service provider data administration**
- **Service provider network data administration**
- **Subscription data administration**
- **Audit administration**
- **Resource accounting**
- **Billing and cost apportionment**
- **Mass changes - NPA splits, LRN transfers**

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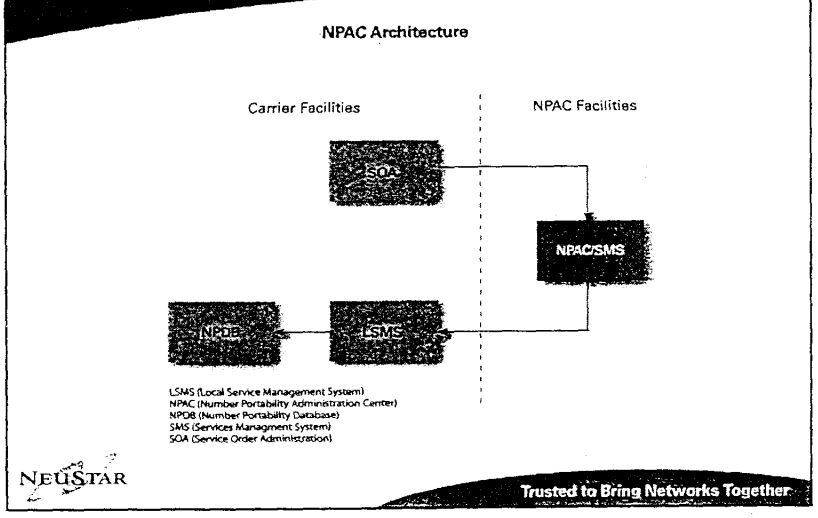
NPAC Architecture



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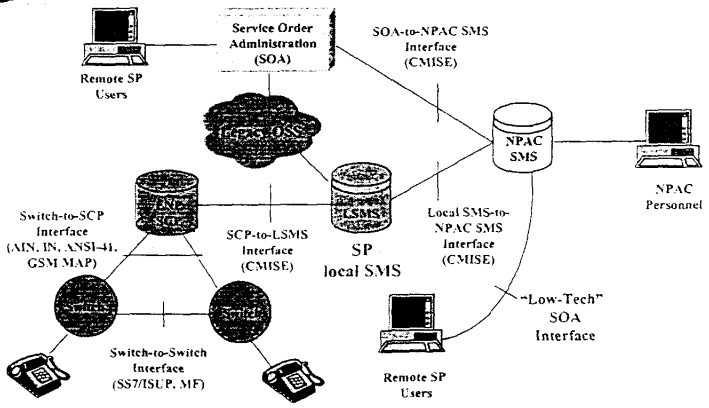
NP Connectivity and Interfaces



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NPAC Service Level Requirements

- Service available 99.9% of the time
- Scheduled service unavailability not to exceed 2 hours per month
- 95% of SOA/LSMS acknowledgement response times are within 3 seconds
- LSMS broadcasts occur within 60 seconds of activation
- 95% of SOA transactions with the NPAC must occur within 2 seconds or less
- 95% of NPAC to LSMS transactions must occur at a rate in accordance with the Performance Improvement Plan

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NPAC Service Level Requirements (2)

- Maintain SOA/LSMS interface availability at a minimum of 99.9%
- A maximum of 10 minutes to cutover to the backup site for unscheduled backup
- Partial restoration (capable of receiving, processing and broadcasting updates) of NPAC/SMS must not be greater than 24 hours
- Full restoration of NPAC/SMS must not exceed 48 hours
- 99.5% of NPAC/SMS tables must be error free

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NPAC Service Level Requirements (3)

- User problem resolution
  - Minimum 90% calls during normal business hours answered by live operators within 10 seconds
  - Less than 2.0% abandoned call rate
  - 99.0% callback within 30 minutes for requests made during other than normal business hours
  - Minimum 99.5% of all commitments met to get back to the user after the initial contact
- Log-on administration
  - Process 99.0% of all approved requests within 12 business hours of receipt
  - Assign user class correctly for 99.5% of all processing opportunities

NPAC Service Level Requirements (4)

- Remedy Log-on security permission errors immediately after user notification
- Notify users within 10 business days of receipt of notification of the need for an NPA split/mass change
- Notify users of routine NPAC/SMS maintenance a minimum of 2 weeks in advance
- Unscheduled service unavailability notification
  - Notify users within 15 minutes of detection of an occurrence of unscheduled service unavailability
  - Provide 30-minute updates of NPAC status following an occurrence of unscheduled service unavailability through recorded announcement and client bulletins

NPAC Service Level Requirements (5)

- Notify users of general availability of NPAC/SMS software releases at least 30 calendar days in advance
- Notify users of delayed NPAC/SMS software releases at least 2 weeks before the scheduled delivery date
- Provide documentation and training on schedule of software release
- Mail to requester of document within 1 business day

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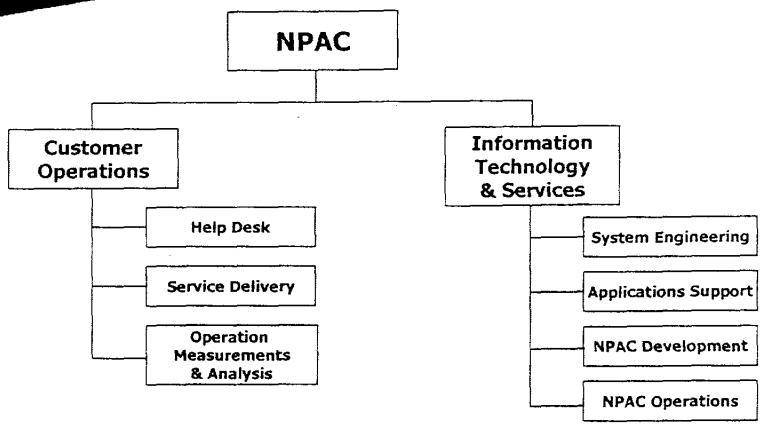
NeuStar NPAC Organization



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The Value of NPAC

- **NPAC provides a master routing database that glues network and service inter-operation together:**
  - Switch routing information and network element identification is kept in LNP database.
  - Ensures full inter-operation of calls and TN-related (e.g. CLASS, roaming) services of similar and disparate network types.
  - Expands to incorporate unique inter-network needs for seamless service portability and inter-operation, e.g. wireless, IP telephony.
- **NPAC provides a technology-neutral way of ensuring seamless service inter-operation between competing networks and their subscribers, now and in the future.**
- **Is key to the competitive network-of-networks vision of the future.**

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Why A Central NPAC?

- The LNP data downloads provide the proper network routing information:
  - NPAC is the master database and is **not** in the call path
- Within a given region, there could be 20 or more service providers that depend on this data for routing
- The integrity of this data is too vital to depend on multiple, direct SP-to-SP connections
- **One** NPAC avoids the "spider-web" created by 20 or more direct SP-to-SP connections—provides efficient distribution of data
- **One** NPAC data base provides for more efficient auditing, trouble shooting, and problem resolution

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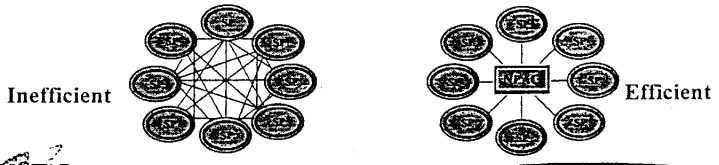
Central NPAC Advantages

With multiple SPs and with increased volumes, centralized master database is more efficient. Master database keys all SP routing databases. Newer entrants test with the NPAC and not with each SP as in the bilateral case. Economies of scale realized in the NPAC.

When using secret key for secure communications, each SP only deals with the NPAC in terms of key management.

In North America, the Industry (with up to 20+ SPs in one MSA and 50+ SPs in a region) went right to NPAC.



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Why a Neutral NPAC Administrator ?

- **Facilitates technical discussions between competing carriers**
- **Safeguards sensitive information**
- **Ensures equal and fair access to vital network routing data**
- **Provides impartial data measurement and analysis**
- **Coordinates LNP implementation and testing**
- **Provides independent and impartial certification of systems and databases**
- **Provides impartial opinions (technical, schedule) to regulators**
- **Is 100% accountable for the service**

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LNP Cost Recovery — U.S.

FCC 3rd Report & Order (CC 95-116) identified three types of LNP cost

- **Type 1 — Shared cost** (recurring/nonrecurring admin. cost)
  - NPAC bills all SPs (> 3,600SPs in the U.S.) based on regional end-user revenue
- **Type 2 — Carrier-specific cost** (dedicated, joint, and share of Type 1)
  - LECs may recover via monthly end-user charge over five years
    - Per month charges range from $.23 (Verizon) to $.43 (US West) to $.48 (Sprint Local) per line
  - Others may recover via "other legal means"
- **Type 3 — Carrier-specific not related to LNP** (network upgrades)
  - Cost of business to SP

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Porting Statistics

- **500M+ working TNs in the U.S.**
- **36M+ ported out TNs in the NPAC DBs to date**
- **121,000+ "NPA+NXXs" reported in use in the U.S.**
- **51,000+ "ported" NPA+NXX codes (at least one # is ported out of that block) in the North America as of June 28, 2002 (~ 42%)**
- **3.5 to 4.5 million transactions processed per month**

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LNP Implementation—Canada

In Canada, Decision 94-19 set a new regulatory framework

- Telecom Order 98-60 set roll out schedule:
  - Two levels of Priority Exchanges starting 7/31/98 and finishing 3/31/99
  - Lockheed Martin(NeuStar) replaced original vendor in May 1998
  - Industry met deadline - July 31, 1998
- Similar but distinct Canadian NPAC solution adopted
- Canada has option to "opt-in" to US NPAC enhancements

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Future of NP

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The Future of NP in the U.S.

- **Wireless porting and wireline-wireless integration**
- **NP data access via IP-based interface**
- **IP telephony integration (wireline-IP, IP-IP, wireless-IP)**
- **Individual telephone number pooling**
- **Location portability (personal number)**

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Information Resources

- http://www.nanpa.com - North American Numbering Plan Administrator
- http://www.npac.com - Number Portability Administration Center
- http://www.ported.com - Number Portability and pooling
- http://www.fcc.gov/ccb - NANC, portability and pooling
- http://www.atis.org - Several national forums (INC, OBF, T1S1)
- http://www.crtc.qc.ca - Canada LNP applications

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NeuStar Thousands Block Number Pooling Services

December 16, 2002

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What is a "Number Pool"?

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Background

- The U.S. Telecommunications act of 1996 made provisions for telecommunications competition in the U.S.
- Numerous new telephone companies entered the market in the major metropolitan areas.
  - Each major metropolitan area in the U.S. is sub-divided into smaller geographic areas called "rate centers" for the purposes of number assignment, rating and routing of calls.
  - Numbers were traditionally assigned to one telephone company in blocks of 10,000 numbers for each "rate center" prior.

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Background *continued*

- As the number of competing telephone companies increased in the major metropolitan areas and the sub-tending "rate centers", the available 10,000 blocks of numbers which could be assigned in the North American Numbering Plan were being depleted at an alarming rate.
  - In some areas as many as 30 telephone companies entered a market (rate center), each requiring at a minimum a 10,000 block of numbers, to serve the same amount of customers previously served by one telephone company.
    - An increase (at a minimum) of 300,000 numbers assigned with no resultant increase in end users.
    - Some market areas have in excess of 50 rate centers.

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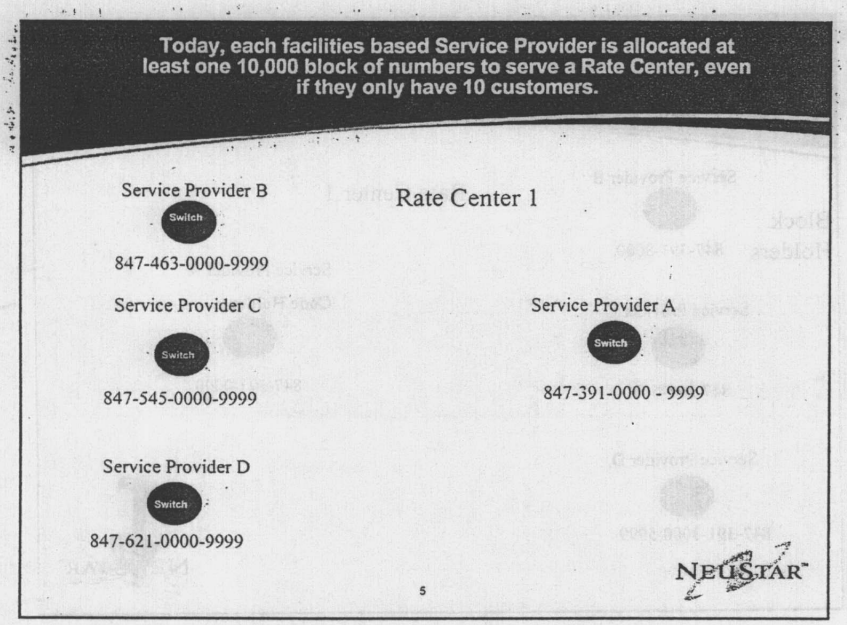
Today, each facilities based Service Provider is allocated at least one 10,000 block of numbers to serve a Rate Center, even if they only have 10 customers.
Service Provider B
Switch
847-463-0000-9999
Rate Center 1
Service Provider C
Switch
847-545-0000-9999
Service Provider A
Switch
847-391-0000 - 9999
Service Provider D
Switch
847-621-0000-9999
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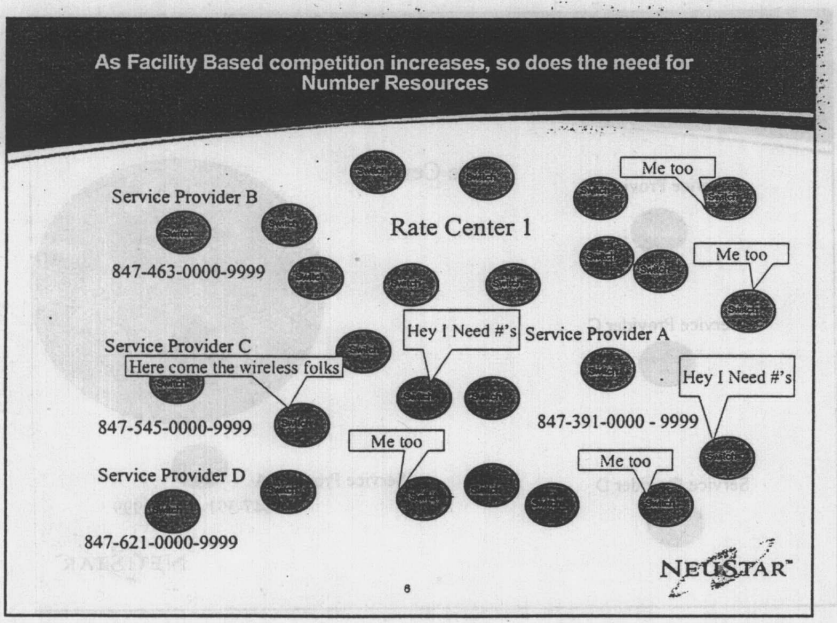
As Facility Based competition increases, so does the need for Number Resources
Service Provider B
847-463-0000-9999
Rate Center 1
Me too
Me too
Service Provider C
Here come the wireless folks
847-545-0000-9999
Hey I Need #'s
Service Provider A
847-391-0000 - 9999
Hey I Need #'s
Me too
Me too
Service Provider D
847-621-0000-9999
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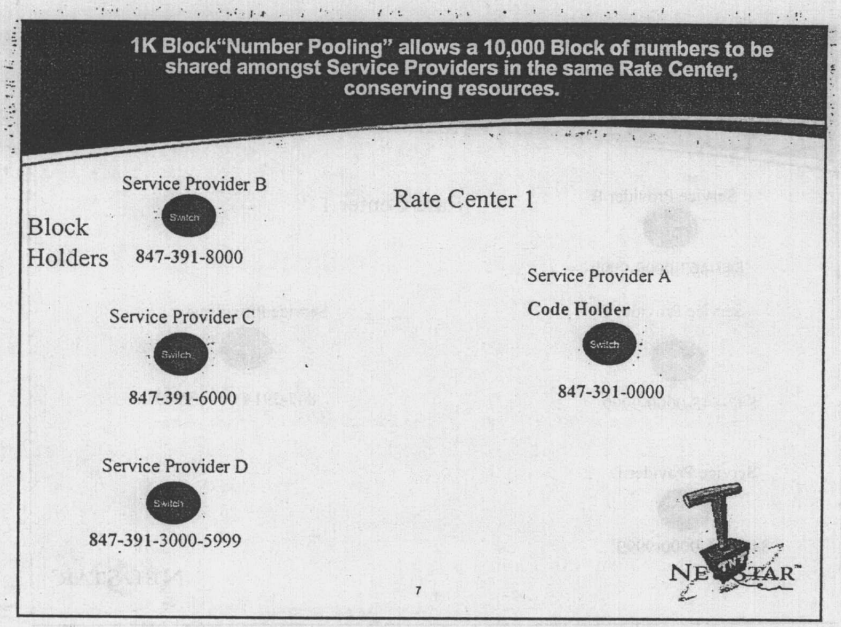
1K Block"Number Pooling" allows a 10,000 Block of numbers to be shared amongst Service Providers in the same Rate Center, conserving resources.
Service Provider B
Switch
Rate Center 1
Block Holders
847-391-8000
Service Provider A
Code Holder
Switch
Service Provider C
Switch
847-391-0000
847-391-6000
Service Provider D
Switch
847-391-3000-5999
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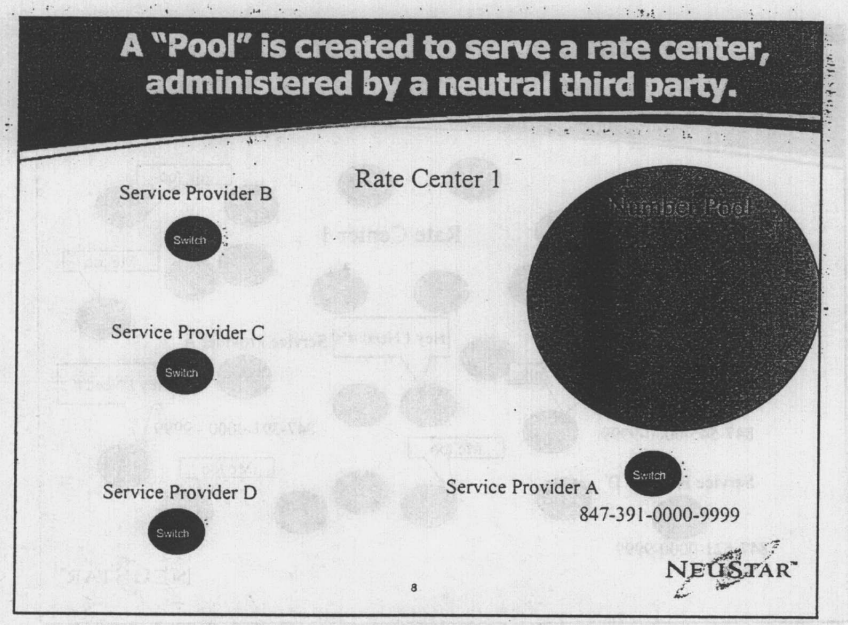
A "Pool" is created to serve a rate center, administered by a neutral third party.
Rate Center 1
Service Provider B
Switch
Number Pool
Service Provider C
Switch
Switch
Service Provider D
Switch
Service Provider A
847-391-0000-9999
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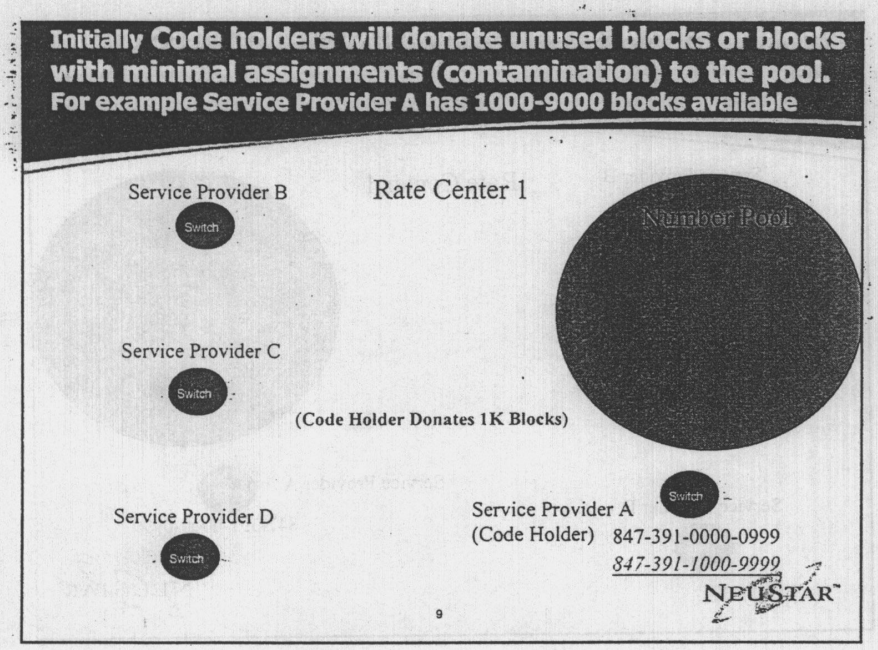
8


Initially Code holders will donate unused blocks or blocks with minimal assignments (contamination) to the pool.
For example Service Provider A has 1000-9000 blocks available
Service Provider B
Switch
Rate Center 1
Number Pool
Service Provider C
Switch
(Code Holder Donates 1K Blocks)
Service Provider D
Switch
Service Provider A
(Code Holder) 847-391-0000-0999
847-391-1000-9999
Switch
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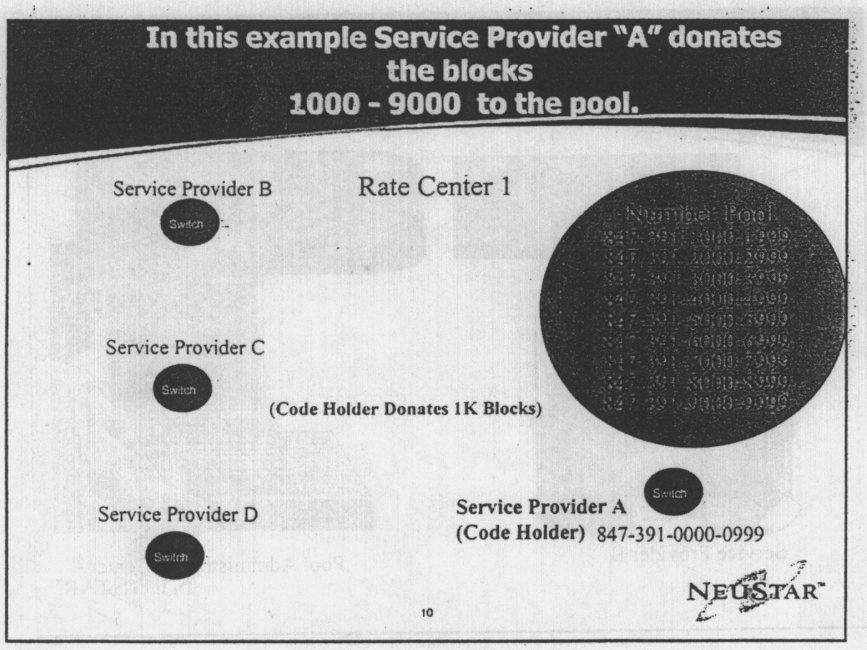
In this example Service Provider "A" donates the blocks
1000 - 9000 to the pool.
Service Provider B
Switch
Rate Center 1
Number Pool
Service Provider C
Switch
(Code Holder Donates 1K Blocks)
Service Provider D
Switch
Service Provider A
(Code Holder) 847-391-0000-0999
Switch
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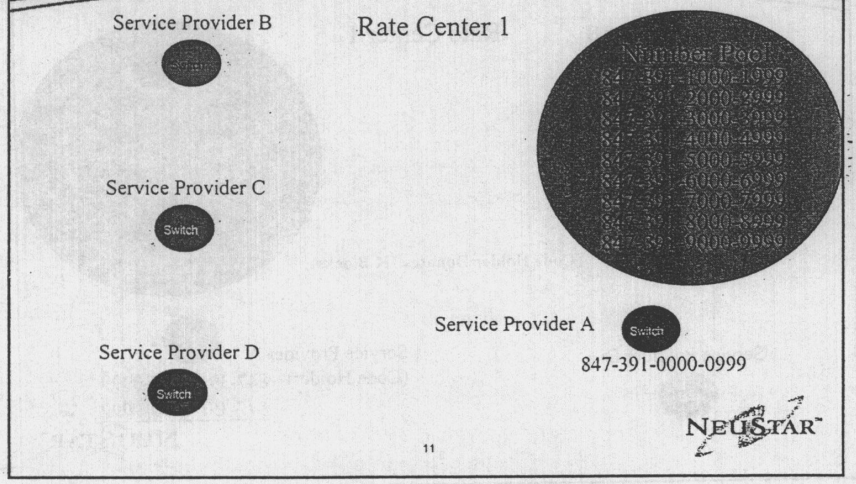
When Service Provider B needs additional numbers, they can send a request to the "Pool" administrator for a block of one thousand numbers instead of requesting a full code being opened.



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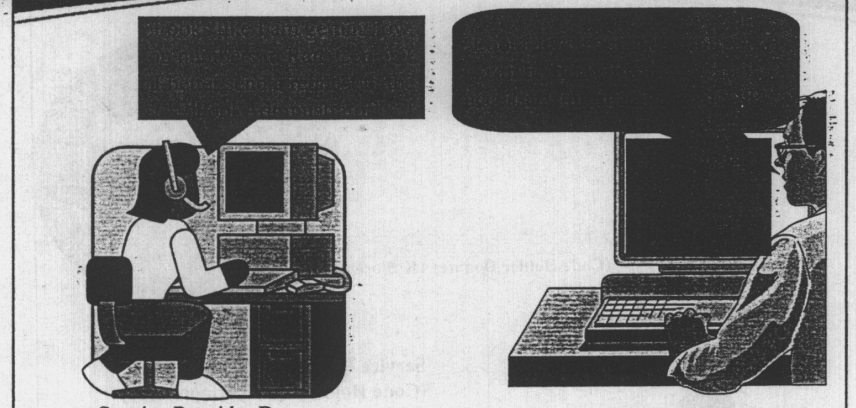
Service Provider B sends a request for a 1K Block due on a specified date



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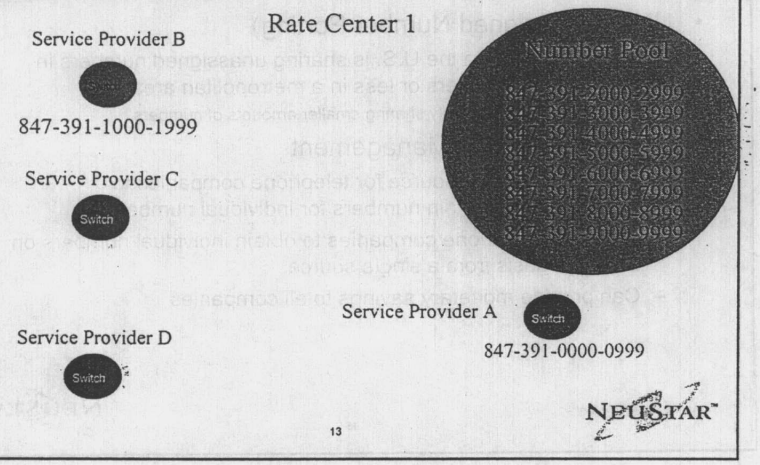
The "Pooling" Administrator (PA) process's the request. If the request can be accommodated, the PA notifies the SP that the request can be accommodated and forwards necessary information to the NPAC so the block can be moved on the effective date.



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What is required to implement Number Pooling?

- Local Number Portability
- Guidelines for telephone companies
- Possible changes to internal telephone companies operation support and numbering administration systems.

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What does the future hold?

- UNP (Unassigned Number Porting)
  - Currently a trial in the U.S. is sharing unassigned numbers in blocks of 50 numbers or less in a metropolitan area
    - Similar to pooling only sharing smaller amounts of numbers.
- Number Database Management
  - A single database source for telephone companies to interconnect to obtain numbers for individual numbers.
  - Allows all telephone companies to obtain individual numbers on an equal basis from a single source.
  - Can provide monetary savings to all companies

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ENUM

James Yu
NeuStar, Inc.
December 17, 2002

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What is ENUM?

ENUM is a scheme that put telephone number into the Domain Name System (DNS) in a single "golden tree" domain so that resources or end point addresses associated with a telephone number can be resolved in the IP domain

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Why are Telephone Numbers Important?

- They are there ...why not use them for VoIP and IP communications
- TNs are the only way for PSTN callers to reach IP devices
- TNs are linguistically neutral
- Familiar to consumers
- E.164 numbering plan is "authoritative" – each TN is globally unique
- Billions of devices do not or will not have Keyboards....

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ENUM Types

- **End user ENUM (e164.arpa)**
  - Identifies end user's IP resources
  - Requires end user opt-in
- **Carrier ENUM (different domain tree)**
  - Jointly used by carriers for network services (e.g., NP, routing)
  - End user opt-in not required
  - May use several domain trees for various services
- **Private ENUM (different domain tree)**
  - For any private use (e.g., enterprise VPN routing)

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ENUM Processes

- **Real-time process**
  - Retrieve NAPTR RRs at the Tier 2 Provider
  - Access additional application-specific data
- **Provisioning process**
  - NS RRs at the Tier 1 Registry
  - NAPTR RRs at the Tier 2 Provider

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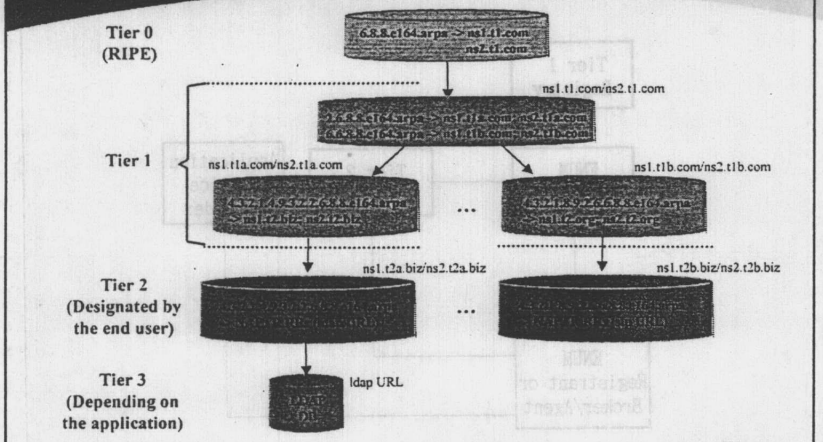
ENUM DNS Hierarchy



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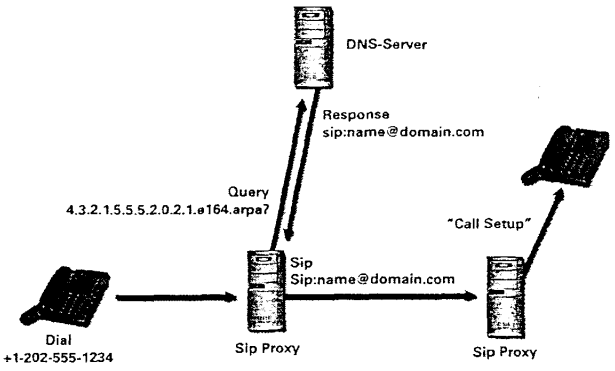
ENUM Example for VoIP via SIP

ENUM equates +1-202-555-1234 to sip:name@domain.com
to enable Voice over IP using SIP



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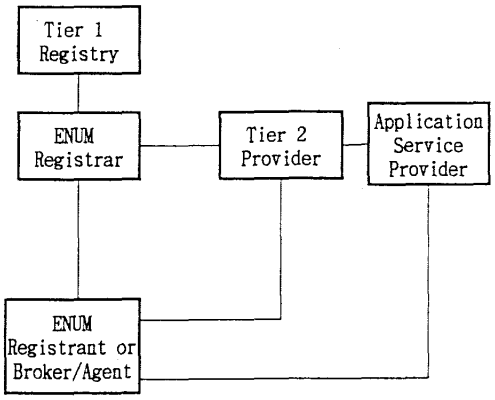
End User ENUM Provisioning



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End User ENUM vs. Existing DNS

ENUM is not different from the existing DNS process except the following:

- **ENUM Registrar must valid ENUM Registrant's identity and that he/she is indeed the current TN assignee**
- **Tier 1 Registry, ENUM Registrar and Tier 2 Nameserver must automatically handle number changes (e.g., area code split, code expansion)**
- **ENUM Registrant's right to use an ENUM domain name is tied to if he/she owns/controls the TN**
  - No IPR issue; dispute resolution is simpler
  - TN disconnect means no ENUM service on that TN

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Global Interests in End User ENUM

- **Many countries established national industry group to address ENUM-related issues**
  - France
  - Germany
  - The Netherlands
  - Sweden
  - Taiwan
  - UK (UKEG)
  - US (ENUM Forum)
- **Netherlands (+31), Austria (+43), UK (+44), Germany (+49) and China (+86) have received CC delegation under e164.arpa**
- **Many companies/organizations planning or performing trials**

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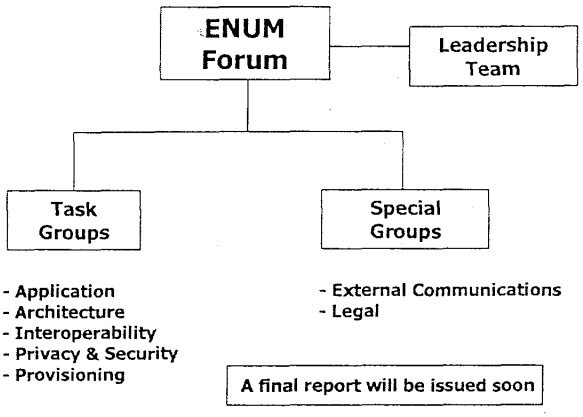
U.S. ENUM Forum Structure



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Key End User ENUM Issues

- **Which TLD to use**
  - .arpa vs. .int vs. a new gTLD
- **Who procures Tier 1 Registry or Registries**
  - Government vs. industry or
  - ccTLD Registry automatically becomes country's Tier 1 Registry
- **Number of Tier 1 Registries**
  - One vs. several: US and UK industries leaning toward single Tier 1 Registry
- **Who can be qualified as ENUM Registrars**
  - Certain qualifications/accreditation vs. no control

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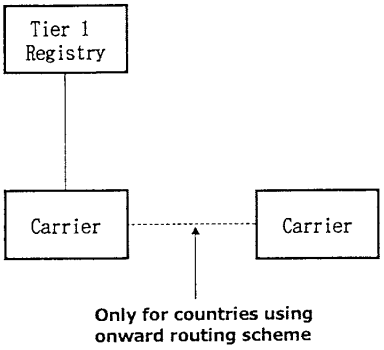
Carrier ENUM Provisioning



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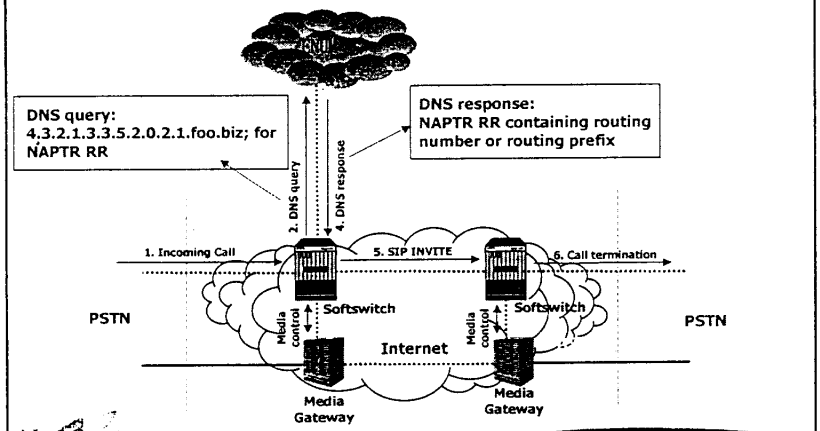
Carrier ENUM - NP Example



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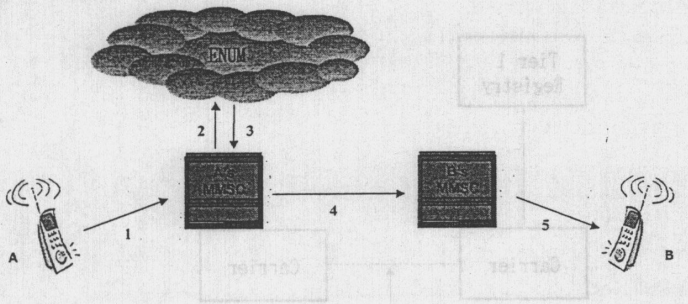
Message Delivery with MNP Using ENUM



1. A sends a message to B and the message is sent to A's MMSC.
2. A's MMSC sends B's telephone number (TN) in the ENUM query.
3. The ENUM process returns the NAPTR RRs.
4. A's MMSC retrieves the NPATR RR associated with the "mms" that contains the domain name about B's MMSC, obtains the IP address of the domain name and sends the message to B's MMSC.
5. B's MMSC delivers the message to B or sends a notification to B.

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ENUM - Threats and/or Opportunities

- **Threats**
  - Calls can be routed to IP end points bypassing the PSTN
  - VoIP service providers can reach TN subscribers via IP-based interface
- **Opportunities**
  - Telephony Service Providers (TSPs) can get into VoIP business and reach other TSPs' subscribers via IP-based interface
  - TSPs are in the best position to perform validation/authentication of TN assignees for ENUM Registrar or act as the broker/agent to register ENUM service for ENUM Registrant
  - TSPs can use ENUM technology to perform SS7 GTT-equivalent functions in the IP domain (e.g., NP, TN --> MMSC mapping)

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Conclusion

Carriers should pay attention to ENUM

- **Potential impacts to the existing business**
- **Additional revenue opportunities**
  - ENUM provisioning
  - VoIP market
- **Use of carrier ENUM in IP-based networks for network convergence**
  - Support SS7 GTT-equivalent functions
  - Access NP and freephone routing data
  - Others such as calling card information

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ENUM Resources

- ENUM core protocol
  - ftp://ftp.isi.edu/in-notes/rfc2916.txt
  - http://www.ietf.org/internet-drafts/draft-ietf-enum-rfc2916bis-01.txt
- ENUM charter
  - http://www.ietf.org/html.charters/enum-charter.html
- ENUM WG requirements
  - http://www.ietf.org/internet-drafts/draft-ietf-enum-rqmts-01.txt
- ENUM call flows
  - http://www.ietf.org/internet-drafts/draft-lind-enum-callflows-01.txt
- ENUM operations issues
  - http://www.ietf.org/internet-drafts/draft-ietf-enum-operation-01.txt
- ENUM administration in the United States
  - http://www.ietf.org/internet-drafts/draft-pfautz-yu-enum-adm-00.txt
- Voice Profile for Internet Mail
  - ftp://ftp.isi.edu/in-notes/rfc2421.txt

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ENUM Resources

- IETF-ITU liaison statement
  - ftp://ftp.isi.edu/in-notes/rfc3026.txt
- ENUM activities at the ITU
  - http://www.itu.int/itudoc/itu-t/circ/01-04_1/026_ww9.doc
- ITU World Telecommunications Policy Forum. ENUM and ITU involvement in ENUM is discussed in the document.
  - http://www.itu.int/wtpf/sgreport/finalreport31Jan.doc
- ENUM web sites
  - International Telecommunications Union
    - http://www.itu.int/infocom/enum/
  - CyberTelecom
    - http://www.cybertelecom.org/teleph.htm
  - NeuStar ENUM test web site
    - http://www.enum.org

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Digital Identity Management

Dec 16, 2002 -- Washington, DC

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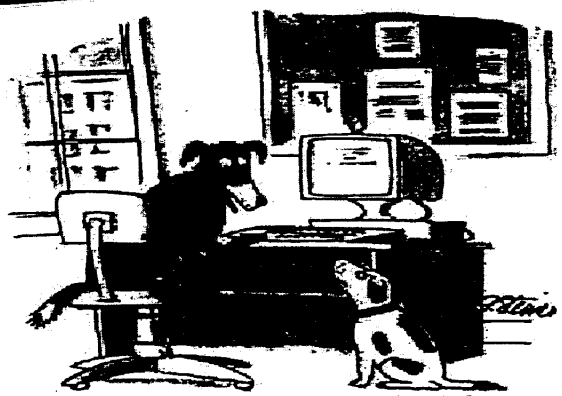
Identity on the Internet



"On the Internet, no one knows you're a dog"

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What is a Digital Identity?

- A Digital Identity is the representation of a human identity that is used in a distributed network interaction with other machines or people.
- A Digital Identity consists of who one is (identity) and the credentials that one holds (attributes of that identity).
- A Digital Identity only needs to be as complete as a particular transaction requires.
- A Digital Identity needs to balance robust and easy to use with control and security.

The Purpose of Digital Identity

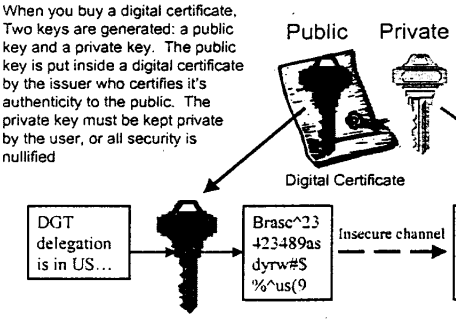
- To restore the traditional human context to today's impersonal, distributed, networked communications world where transactions arise ad hoc is a very personal task in an inherently impersonal setting, and ultimately, is the purpose of the Digital Identity.
- Digital Identity will return the ease of use and trustworthiness of identity-based transactions that existed when interactions were done face-to-face with parties that already knew each other (or both knew a third party) while maintaining the security and accountability for the transaction.
- The concept of Digital Identity will evolve to include the capability to express all of the various human identity interactions, driven by economic, political and social factors along the way.
- Only with a robust Digital Identity can the true power of distributed, peer-to-peer networking technology and applications be released.

The Functions of Digital Identity

- **Authentication** - Proving the Digital Identity is what it is representing itself to be in the transaction (something you have, you know, and/or you are)
- **Authorization** - Gaining permission to access certain data or program applications
- **Confidentiality** - Assuring that an unauthorized party cannot usefully intercept the data being transmitted (encryption)
- **Data Integrity** - Assuring that the data has not been tampered with during transmission (digital signature)
- **Proof of Source** - Using public/private key encryption to assure the origination source of a document (PKI)
- **Non-Repudiation** - Using public/private key encryption to verify the source and destination entity of a transaction
- **Reputation** - Aggregating signed information from various sources as credentials based on past transaction history

Public Key Cryptography and PKI

When you buy a digital certificate, Two keys are generated: a public key and a private key. The public key is put inside a digital certificate by the issuer who certifies it's authenticity to the public. The private key must be kept private by the user, or all security is nullified



Two basic problems with PKI:

- There's no standard way for an app to discover and obtain a digital certificate, no PKI inter-op function
- Keeping the private key secure, without costly smartcards and readers

(NeuStar has solutions to both)

E-Commerce Market Trend in Asia-Pac

- 35% growth of online retail sales in 4Q02, faster than U.S.
  (source: GartnerG2)
- $1.6 trillion online B2C sales expected in '04, 2nd largest market next to U.S.
  (source: Forrester Research)
- By 2004, market share of the region (excluding Japan) will be doubled to 10% of the global e-commerce dollars, while the share of U.S. will be decreased from 46% to 38%
  (source: IDC)

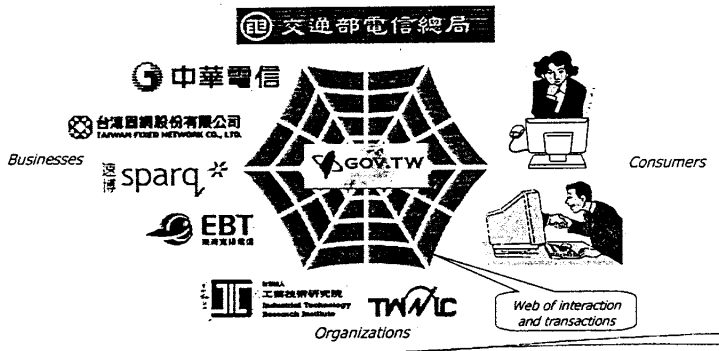
Barriers to On-line Purchasing

- **Credit card security: 79%**
- **Disclosure of personal details: 77%**
- **Distrust of Web retailers: 48%**
- Unfamiliar with online Web storefronts: 40%
- Complex order process: 21%
- Time consuming order process: 20%

(source: PwC)

Identity Management – the Needs

Consumers, Businesses, organizations, and the Government need to identify and authenticate actors for on-line interaction and transactions



Identity Management – the Needs (cont'd)

- Average user spends 16 minutes/day authenticating and signing in
  - For a 10,000 user organization, it's 2,667 hours/day (or 1.3 FTE equivalent)
- 45% of help desk calls are password reset
  - Automated password reset would reduce call volume by a third
  - Estimated savings for a 10,000 user organization is $648,000/year
- Managing users, user stores, and authentication and access control: an average of 54,180 hours/year
  - 25% of improvement in efficiency is 13,545 hours (or 6.7 FTE equivalent)
- Time saving of centralized/consolidated user store management alone: an average of 1,236 hours/year

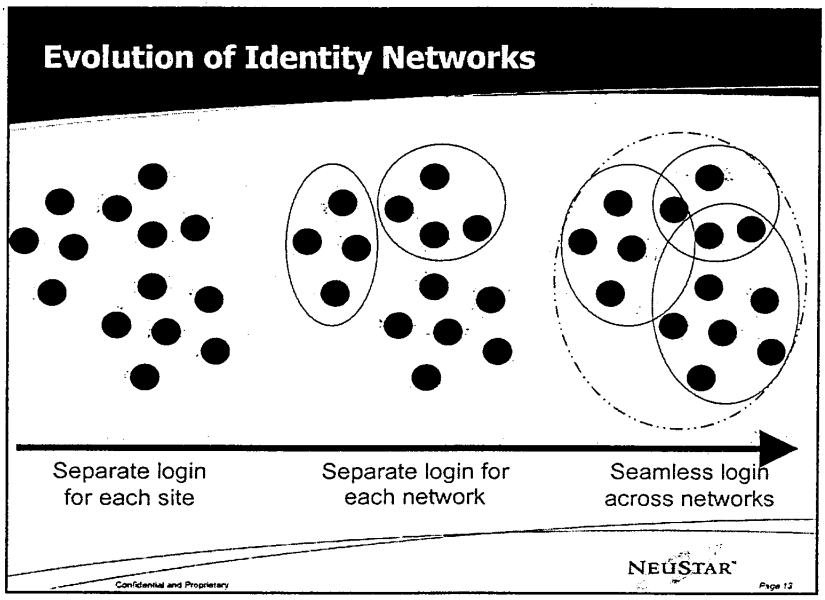
(source: META Group White Paper, "*The Value of Identity Management*")

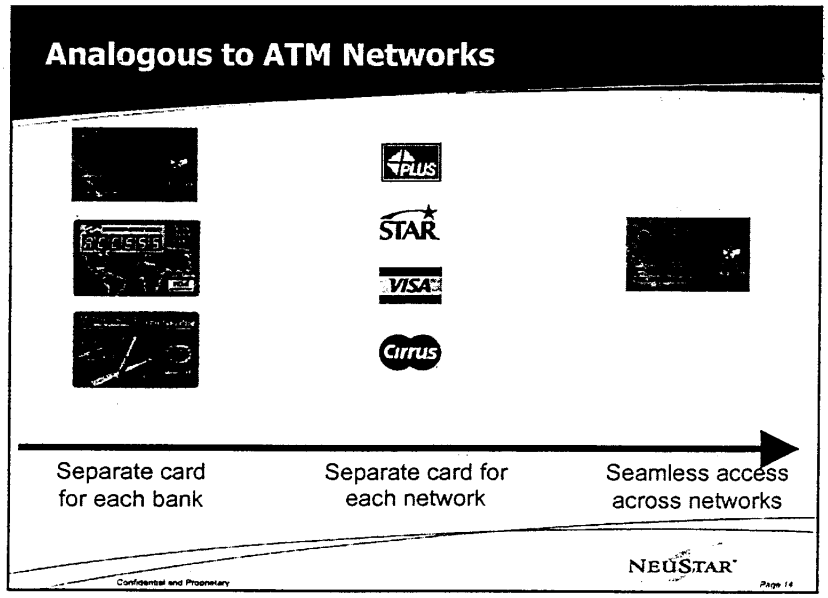
Identity Management – Current Problems

- No standards for coordinated management of user identity across systems or companies
  - User identity is inherently disaggregated and uncoordinated today
  - Separate userid/passwords for each company/system/application
- No coordinated identity management within online transaction environments and within large corporations
  - Huge problem for large corporations and trading communities
  - No way to manage authentication and authorization for users spanning multiple applications, systems, and organizations
- Merchants can not accept a userid and password issued to a user by another entity (e.g. user's bank)
- Online consumer credit card fraud estimated $2.1B in '02 in US alone
  - Will grow 300% in '03 in proportion to total online purchases
  - 10-15x higher than "card present" in-store purchases
- Low conversion rates for online referral sales due to re-enrollment
  - No standard way for companies to exchange customer profile information

Identity Management – Technologies

- Identity is a hot-button issue, but addressing it requires infrastructure technologies
  - Directory services (such as LDAP)
  - Web-based access management: policy-driven access controls
  - Provisioning: managing life cycles (users and privileges)
  - Identity administration: mapping users to roles, groups
  - Portals: providing presentation/personalization policies
  - Public identity systems and standards
- Identity and access management is not a system
  - Must become a pervasive and federated infrastructure
  - Must support both centralized and decentralized scenarios
  - Must accommodate integration where practical, federation where necessary


Evolution of Identity Networks
Separate login for each site
Separate login for each network
Seamless login across networks
NEUSTAR
Confidential and Proprietary
Page 13


Analogous to ATM Networks
PLUS
STAR
VISA
Cirrus
Separate card for each bank
Separate card for each network
Seamless access across networks
NEUSTAR
Confidential and Proprietary
Page 14

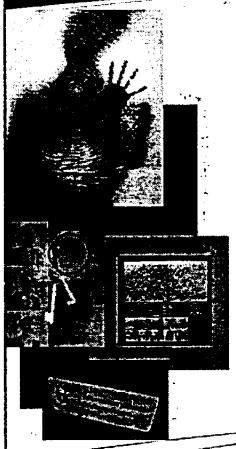
Federated Identity Concepts

- Federated identity management are agreements, standards, and technologies that make identity and entitlements portable across autonomous domains
  - Relying parties do not need prior knowledge of complex system internals or pair-wise mappings between systems
  - Federation standards define rules that bind autonomous identity domains to a common method of exchanging identity information
  - Federation standards provide framework for negotiating agreements, defining interactions
  - Heterogeneous systems can map to the federation standards by applying transformations at the boundaries between domains
  - Relying parties can honor each other's decisions and trust each other's assertions, but in the context of their own local policies

Federated Identity Challenges

- Competitive disincentives between identity domains, or federated clusters of identity domains
- Web security issues related to user interfaces, cookies, DNS, SSL, denial of service, and central point of failure
- Lack of scalable trust models, with PKI still struggling
- Incompatible protocols, lack of a standard for representing entitlements data
- Inconsistent privacy policies between identity domains
- Bottom line: Multi-party federations much more difficult to set up and administer than peer domain federation

Liberty Alliance - Mission



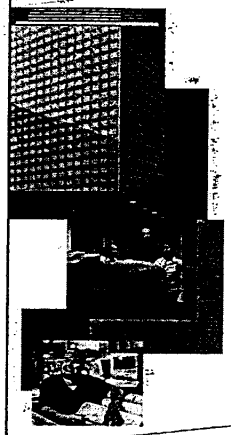
Establish an open standard for federated network identity through open technical specifications that will:

- Support a broad range of identity-based products and services
- Allow for consumer choice of identity provider(s), the ability to link accounts through account federation, and the convenience of single sign-on, when using any network of connected services and devices
- Enable commercial and non-commercial organizations to realize new revenue and cost saving opportunities that economically leverage their relationships with customers, business partners, and employees
- Improve ease of use for e-commerce consumers

Why is Liberty Alliance Needed?

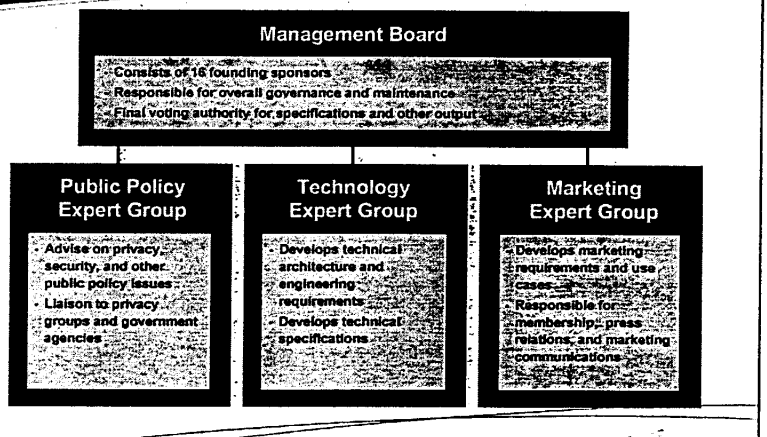
- Increase consumer confidence and usage in electronic transactions
  - Easier and more convenient to use
  - Available via any digital device
  - As secure as possible
  - Targeted and more personalized
  - Enable e-commerce offerings that allow consumers to maintain control over their network identity and personal information
- Simplify B2B e-commerce offerings
  - Simplify and foster the ability for businesses to collaborate online offering new services to customers
  - Allow commercial and non-commercial organizations to maintain ownership of their customer bases and to maintain their operational autonomy
- Simplify and expand employee use of enterprise Intranets
  - Enable employees to move seamlessly from one application to another
- Facilitate interoperability
  - With existing systems, standards, and protocols

Liberty Alliance - Membership

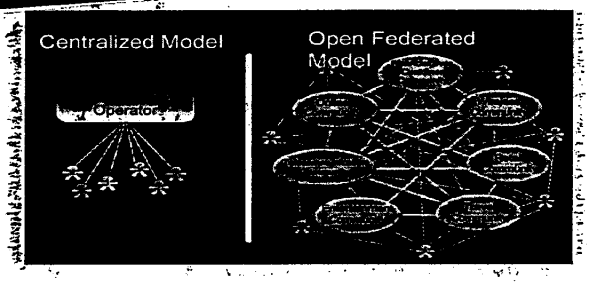


- Over 150 active members, representing over a billion customers worldwide (NeuStar is one of the 32 sponsor members)
- Broad and global coalition of companies galvanized by a common vision
- Members represent a wide range of industries, including:
  - Transportation
  - Financial services
  - Mobile phone and wireless service providers
  - Internet service providers
  - Hardware and software suppliers
  - Security and web services companies
- Open alliance that welcomes and encourages participation by all commercial and non-commercial organizations

Liberty Alliance - Management Structure



The Liberty Model – Federation



- Single repository
- Centralized control
- Single point of failure
- Links similar systems

- Multiple repositories in various locations
- No centralized control
- No single point of failure
- Links similar and disparate systems

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Internet Registry Services Overview

Taiwan Delegation

December 17, 2002

Why Internet Registry?

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- Mission Critical Infrastructure
  - Mission critical business and government applications moving to Internet
  - Citizens increasingly rely upon the Internet for day-to-day activities
- Well Suited for Neutral Third Party Approach
  - Registry only
  - Do not compete with registrars
  - Code of Conduct
  - All registrars receive equal access and treatment
- Platform for convergence and value added services
  - ENUM
  - Digital Identity

Current Services

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- Exclusive Registry for .BIZ
  - gTLD Exclusively for Business
  - Agreement with ICANN
- Exclusive Registry and Administrator for .US
  - United States Country Code
  - Agreement with Department of Commerce
  - Technical and Policy role
- Over 1 Million Names under Management
  - Over 700,000 .BIZ names
  - Over 400,000 .US names
  - Adding over 40,000 new names every month
- Registry Gateway provider for .CN under agreement with CNNIC
- Postminder and Biz Promote value added services

Internet Registry Architecture

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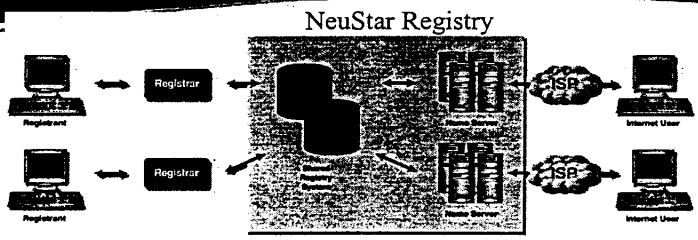

- Telco Grade Data Centers
- Highly stable and reliable service delivery: 99.999% Availability
- Open and simple interface to maximize distribution channels: XRP Standard
- "Thick" registry model provides improved data integrity
- 15 minute updates to name servers to shorten provisioning cycle

.CN Registry Gateway

NEUSTAR

- New Policy
  - Competitive Registrar Model
  - International registration
  - Real-time registration
  - No documentation required
- CNNIC is the Registry
  - Registration system and authoritative database is in Beijing
  - CNNIC operates DNS and Whois
- NeuStar services for registrars outside of China
  - Hubbing to connect to CNNIC registry
  - Faciliate registrar contracts
  - Billing and customer service
- Initially Third-Level Names
- Second level targeted for March 16th
- Includes Chinese language names

.CN Registry Gateway

NEUSTAR

- Objectives and Benefits
  - Increase worldwide registration of .CN domain names
  - Promote International Trade with China
    - Provide foreign businesses with an Chinese identity on the Internet
  - Instant access to NeuStar registrar channel
    - 90+ registrars and thousands of resellers
  - Other Areas of Cooperation
    - ENUM
    - Multilingual Domain Names

Registry Gateway Architecture

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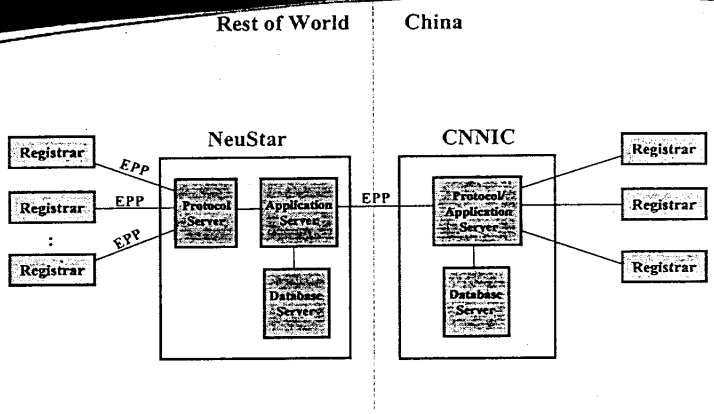

Market Analysis

NEUSTAR

- Domain Market
  - Protector/Speculator bubble continues to burst, but .....
  - 800K new domain years added per month to .COM
  - 1.4M new domain years added per month in all TLDs
  - 75K new domain years added per month in .BIZ and .US
  - .BIZ and .US are 15% of .COM market and 10% of total market
- Related Markets
  - Email market
    - 135M users in the US growing, growing in excess of 10%
    - 50% of US consumers do not have email
  - Hosting market:
    - US market growing in excess of 40% in 2002; fueled by SME market
    - 60% of US businesses do not yet have a web site