

**Comments Submitted By:**  
**NeuStar, Inc.**  
*(August 30, 2005)*

**In Response to**  
**TRAI Consultation Paper on MNP**  
*(Consultation Paper No. 7/2005)*



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## INTRODUCTION

The Telecom Regulatory Authority of India (TRAI) released the Consultation Paper on Mobile Number Portability (MNP) (the “Paper”) on July 22, 2005.

TRAI has invited all stakeholders to participate in a collective thinking process about number portability (NP) in India, and requested comments from all interested parties in response to 17 questions raised in the Paper.

As the exclusive administrators for the Number Portability Administration Center (“NPAC”, [www.npac.com](http://www.npac.com)) in the US and Canada, the North American Numbering Plan (“NANP”, [www.nanpa.com](http://www.nanpa.com)), and the National Number Pooling ([www.nationalpooling.com](http://www.nationalpooling.com)) in the US, NeuStar, Inc. (“NeuStar”, [www.neustar.biz](http://www.neustar.biz), NYSE:NSR) has 10 years of hands-on NP design, implementation, deployment, operations, and administration experience. All of these franchises were awarded through open, competitive procurement processes.

In addition to North America, NeuStar has also been actively involved in NP initiatives worldwide. In December 2004, through an open, competitive Request for Proposal (RFP) process, NeuStar was awarded an exclusive contract to design, implement, deploy, support and maintain the NPAC system for all mobile and fixed operators in Taiwan. The Taiwan MNP and Fixed Number Portability (FNP) Services will be launched in October 2005.

NeuStar has a group of industry recognized and respected subject matter experts in NP. Their experience and expertise cover areas such as regulatory policies, operator NP implementation and deployment, NP business and operations porting flows, NP standards and specifications, FNP, MNP, inter-modal NP, NP business models, cost recovery and allocation mechanisms, centralized NP database design, implementation and operations, value-added services that resulted from and enabled by NP. Our co-founder and CTO, Mark Foster, was one of the lead inventors of Local Number Portability (LNP).

As the neutral 3<sup>rd</sup> party, NeuStar welcomes the opportunity to work closely with TRAI, all Indian operators, and other local constituencies to find the best NP solution with the most realistic implementation timeline that would be most suitable to India and beneficial to all stakeholders.

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## RESPONSE TO TRAI QUESTIONS

### 1. What is the anticipated impact of number portability on customer satisfaction and increased competition between services and operators?

NeuStar Comments: As it was stated in the TRAI Consultation Paper (the “Paper”), number portability (NP) removes barriers to competition between operators and services and ensures a dynamic, fully competitive market.

Since 1996, NP (FNP and/or MNP) has already been implemented in 20 some countries. Recently, mainly driven by MNP, NP has gained significant momentum globally. While in various stages, countries such as Taiwan, Malaysia, Pakistan, Saudi Arabia, Israel, New Zealand, Japan, China, South Africa, Turkey, Poland, and Brazil have all started the process of implementing NP. Countries such as UK and Singapore have started looking for permanent NP solutions to replace “onward routing” (a.k.a.: “call forwarding”).

Based on industry initiatives in the US and other countries where NP is available, the increased competition amongst operators has not only been based on pricing but more so on quality of service in network coverage and customer support. Operators have been motivated to offer new, unique, and competitive services to keep customer loyalty. As such, new technologies and innovations have been realized in rapid pace, benefiting the subscribers and the whole industry.

In the US for example, as pointed out by the Paper, the largest mobile operator, Verizon Wireless, gained most subscribers due to its better quality of network and customer service. Additionally, fixed subscribers have been migrating their numbers to mobile. Operators such as Sprint are now consolidating its fixed and mobile operations to reduce costs and offer integrated, packaged services. This, by the way, is consistent with the fixed and mobile convergence endorsed by Next Generation Networks (NGNs) via IP Multimedia Subsystem (IMS).

In Taiwan, even though NP service will not be launched until this October, a recent subscriber survey by “Business Today” predicted that Chunghwa Telecom would have the best porting-in to porting-out ratio. The same survey also indicated that Chunghwa Telecom has the best customer satisfaction on network coverage but worse customer satisfaction on pricing, among three largest mobile operators in Taiwan.

Lastly, in addition to facilitate subscriber competition, a well designed and operated centralized NP platform could/would also enable operators to perform internal network/switch related operations, most cost effectively and with least service interruption to subscribers.

For example, the centralized NP platform in the US, called Number Portability Administration Center (NPAC), has been used by operators to perform network/switch technology migrations (i.e.: TDMA to GSM, 2G to 3G), traffic engineering, load balancing, maintenance and disaster recovery. In addition, the NPAC has also been used to manage telephone numbers more efficiently (a.k.a.: “Number Pooling”) since 2001.

With this said, NeuStar fully realizes the fact that India is a very large and vastly growing market with a lot of uniqueness that we can’t fully appreciate yet. As a neutral 3<sup>rd</sup> party with extensive experience and subject matter expertise in NP, we would welcome the opportunity to work closely with TRAI, all operators, and other local constituencies to find the best NP solution with the most

realistic implementation timeline that would be most suitable to India and beneficial to all stakeholders.

**2. The following technical options have been discussed in the consultation paper. Please indicate your preference with reasons: (a) All-Call-Query; (b) Query-On-Release; (c) Onward Routing (Call Forwarding); (d) Call-Drop-Back; and (e) Any other solution**

NeuStar Comments: in addition to what the Paper has stated, a quick comparison of a few selected key considerations of those four options is depicted in the Table below:

	Off-switch		On-switch	
	(a) ACQ	(b) QoR	(c) OR <sup>(2)</sup>	(d) Dropback
Involve donor network	No	Yes	Yes	Yes
Physical call segment	One	One	Two	One
Database	Centralized (all ported numbers)	Centralized (all ported numbers)	Local/internal (only ported out numbers)	Local/internal (only ported out numbers)
End-to-end CCS7 connectivity (call)	No	Yes	No	Yes
Facility Efficiency	Best	Less	Least	Less
Initial Costs	High	High	Lower <sup>(1)</sup>	Lower <sup>(1)</sup>

Please note that: (1) The total costs for Options (c) and (d) grow exponentially with the increase of ported numbers; and (2) Option (c) will not facilitate location portability (not local call forwarding any more).

More specifically, the on-switch solution is technically not efficient nor operator neutral, since it relies on the donor network's switch to apply the routing information for an incoming call to a ported-out number. It also requires that the donor operator traces all their ported-out numbers which they no longer serve.

In addition, the onward routing solution is not suitable for porting from 2G to 3G since the subscriber would not be able to realize the 3G specific services when a session is routed through a donor network's 2G system. Other issues include calling line identification (CLI) and IP-based services such as multimedia messaging service (MMS).

The above captured comments are among the reasons why onward routing countries such as UK and Singapore are working on replacing it to support increased porting volumes and the strong market demand on 3G and IP-based services.

As for off-switch options, both ACQ and QoR require queries to a centralized NP Database (NPDB). QoR queries the NPDB only when the called number has ported out of the donor network, so it queries less than ACQ. However, QoR does involve the donor network, which is less efficient and not operator-neutral in a competitive environment. And it also needs additional standards-work to pass the "number ported out" indication, a new call release reason, in the CCS7 ISUP parameter, which requires the donor network's switch software upgrade to return the new release reason when it receives an incoming call to a ported-out number.

Therefore, as indicated in the Paper, a majority of the NP countries in Europe have selected ACQ as their elected long-term NP solution, which is the most fair and efficient option. Other ACQ countries include US, Canada, Taiwan and South Africa. While the initial implementation costs might be higher, this solution would be justified in a long run, and evident when the porting volumes increase.

Just as a point of reference, a US study indicated that it would be more expensive to implement/operate under OR than ACQ when 12% of the numbers are ported. However, please note that the study was done by a major operator back in 1996 for FNP based on data from one US State. To fully understand the cost comparison between these two solutions in India, a new study under India's unique situations is definitely needed.

**3. In the past, some countries have followed the approach of implementation of a short-term solution, with parallel planning for a long-term solution. Several other countries have opted directly for a long-term solution. The issues associated with either approach are discussed in this paper. Please give your opinion, with reasons, on the path India should adopt.**

NeuStar Comments: Migration between solutions within the same category (i.e.: off-switch or on-switch) has proven to be an expensive and time consuming exercise. Migration from an on-switch solution to an off-switch solution would be even more difficult, if not impossible – technically, one would have to build the platform from scratch again, in order to upgrade from OR to ACQ.

NeuStar believes it would be very helpful for TRAI to talk with regulators in OR countries such as UK and Singapore to fully appreciate the limitations of OR solution and the challenges of upgrading from on-switch to off-switch solution. We strongly recommend that TRAI plan carefully in order to find the appropriate, long-term solution at the beginning.

In the US, while centralized NPDB and ACQ was initially chosen, a phased implementation approach was adopted based on geographical regions, which mirrored the seven Regional Bell Operating Territories (RBOCs, each with its own regional NPDB), Metropolitan Statistics Areas (NP is mandated in the top 100 MSAs first), and service type (FNP first and followed by MNP) were adopted and proven to be working very effectively.

Considering India's geographic/population size, market growth rate and diversity/regional nature, we believe a phased implementation approach with one selected long-term solution might be a more appropriate way to go.

As a neutral 3<sup>rd</sup> party with 10 years of hands-on NP design, implementation and operations experience (and lessons learned) in US, Canada and Taiwan, NeuStar would welcome the opportunity to work closely with TRAI, all operators, and other local constituencies to find the best NP solution with the most realistic implementation timeline that would be most suitable to India and beneficial to all stakeholders.



**4. In case of a centralized database approach, who should be responsible for the setup, ownership, administration, and management of such a database? Should the administration and operation of a centralized database be assigned to a third party duly licensed by the licensor as another service provider (OSP) on the lines of a clearing-house, or should some other approach be adopted?**

NeuStar Comments: A centralized database approach with a neutral 3<sup>rd</sup> party administrator is the most fair and efficient option.

A neutral 3<sup>rd</sup> party administrator ensures that all competing operators are all treated in a fair and even-handed matter, and their customer data and all other confidential and sensitive information is not shared with others.

## **5. How should the database updates between different operators be synchronized? Where could the central database be located?**

NeuStar Comments: In a centralized database model, real-time updates shall be originated at the central database and broadcast to the operators' local databases for synchronization.

Depending on the actual porting volumes and service level requirements, the broadcast and synchronization could be done over direct, dedicated network links, dial-ups, or secure VPN connections over the Internet.

To ensure reliability and high-availability, it is prudent to have two fully redundant databases in two physically separated data centers (one in Northern India and one in Southern India, for example). In case of disaster in the primary data center, the whole NP operations (including the centralized database) can be failed over to the secondary data center within a very short period of time (e.g.: within 10 minutes in countries such as the US, Canada, and Taiwan).

**6. What should be the level of centralization (metro, circle, national) for a centralized database? Should this be a permanent arrangement, or be subject to later revision?**

NeuStar Comments: There should be a neutral 3<sup>rd</sup> party as the sole centralized NP database administrator for common interfaces and practices, and consistent operations and customer care.

There could be multiple regional NP databases for a country as large as and dynamic, and diversified as India. However, these regional databases could be centrally located in two shared data centers as indicated above under Question #5.

This is how it is currently done for the seven regional NP databases in the US.

## 7. How should NLDOs and ILDOs handle the routing of calls to support number portability?

NeuStar Comments: The originating operator must have appropriate options to successfully and economically terminate a call to a ported number. In countries where NP has been deployed, a range of options have arisen, based on a combination of regulatory policies, industry structures, market dynamics, operations and technical considerations.

The general practice is that whoever collects the fee from the caller does the NPDB query when only service provider portability is involved. When location portability is supported, the originating local operator would normally do the NPDB query because the number could be ported from another remote location to the area local to the originating network (e.g.: a number from Northern India was ported to a city in Southern India). In that case, whether the operator who bills the caller (if different from the originating operator) should compensate the originating operator for the query performed is a subject for further discussion.

So generally speaking, for a domestic long-distance call, the local operator can route the call to the NLDO that should perform the NPDB query and route to the destination network/switch. For an inbound international call, the ILDO that receives the incoming call from another country should do the NPDB query and route the call via proper NLDO to the destination local operator.

NeuStar welcomes the opportunity to work closely with TRAI and operators to find the most optimized query and routing solution for NLDOs and ILDOs in India.

**8. Are the existing interconnection arrangements (such as signaling) between mobile-to-mobile, mobile-to-fixed networks sufficient to achieve number portability, or are any changes required?**

NeuStar Comments: Generally speaking, signaling protocol and switch software upgrades are required to support NP. The existing interconnection arrangements can stay the same as long as the same routing principles are used. Under this approach, the switches need to know which number in which parameter should be used for call routing.

In the US, for example, after performing an NPDB query, the routing number (with the same format as the dialed number) is used as the called party number for call routing. In this case, the routing tables that were used prior to the implementation of number portability are still being used. The same applies to the interconnection arrangements for signaling. Just like the switch upgrades to support routing involving NP, the signaling networks also need to be upgraded to support global title translations on the full phone numbers after NP, as compared to on the phone number prefixes before NP.

NeuStar welcomes the opportunity to work closely with TRAI, operators and switch vendors to find the best NP solution with the least impact to existing interconnection arrangements in India.

## 9. Are there any technical issues in the portability of services such as SMS, data, voicemail, or fax?

NeuStar Comments: Services based on IP, as opposed to CCS7, can only be supported through the centralized database approach. This represents the most cost effective approach to design and implement the centralized database needed to support domain name system (DNS) look-ups for IP-based services, such as MMS, VoIP, and push-to-talk over cellular (PoC).

SMS is generally routed over the CCS7 networks, so these networks need to be able to route based on the full phone number instead of the phone number prefixes as described in comments to Question #8 above. If SMS could be routed via an IP network, its routing information would also be obtained via a DNS look-up to access a copy of the centralized database.

These are just a few examples we have experienced in US, Taiwan and other NP countries NeuStar has been involved in, and we welcome the opportunity to work closely with TRAI, operators, and other service providers to make sure that the selected NP solution will work for value-added services such as SMS, data, voicemail and fax.

**10. What problems do you foresee with the current National Numbering Plan in implementing number portability that may necessitate the modification of the existing National Numbering Plan?**

NeuStar Comments: Generally speaking, there should not be any major impact on the national numbering plan, especially since the primary focus here is mobile operator portability.

Based on the MNP adoption rate, in the long term there may be a need to modify the concept of number range holder (NRH) and the rules for number range assignments.

On the other hand, NP may help the conservation of numbering resources by introducing number pooling or individual number assignment. In the US, the National Number Pooling program mandated by the Federal Communications Commission (FCC) has been one of the value-added applications for the NPAC.

As the exclusive NPAC, National Number Pooling, and North American Numbering Plan (NANP) administrators in the US, NeuStar welcomes the opportunity to work closely with TRAI and operators to ensure the selected NP solution works best with the existing National Numbering Plan in India.

## **11. Should number portability related charges be regulated? If not, then what measures will ensure that the portability charges are not set such as to discourage portability?**

NeuStar Comments: In the US, the regulator (FCC) allowed operators to recover NP related costs via a Cost Allocation Methodology that assesses a monthly NP surcharge to each served subscriber. These costs, however, must be approved by the FCC before being applied. The duration of that surcharge was also set by the FCC.

In Taiwan, a one-time portability fee will be paid by the subscriber to the losing operator. However, the regulator (DGT) has set up a cap for this fee.

Different cost recovery models have been adopted in different countries, based on their unique situations. NeuStar suggests TRAI to study all available models and associated pros and cons to make a right decision for India.



## 12. What measures will ensure tariff transparency?

NeuStar Comments: Calling Party Pays (CPP) requires that a subscriber has the ability to be advised of any costs associated with a phone call. This advice is typically provided via the use of the National Numbering Plan to identify calls to a particular Public Land Mobile Network (PLMN) or other higher cost network termination subscribers.

MNP makes it difficult for subscribers to identify the mobile network that they are calling. If there is a significant difference in call termination rates to a particular mobile network, the serving operator may need to charge more.

Ideally, competitive market conditions will solve this particular problem. But if a mitigation measurement is to be considered, we are aware of, in at least one NP country, that an originating operator provides a message during call setup to identify a ported number.

As the neutral 3<sup>rd</sup> party who has no intrinsic interest or investment in any telecom operators and does not interact directly with subscribers, NeuStar welcomes the opportunity to assist TRAI and operators in India to identify and understand any tariff transparency issues and ultimately find proper mechanisms to solve or mitigate them.

**13. Considering that the Indian market is a growing market and number portability offers the possibility of attracting customers by an efficient operator, should it be mandated that the cost of the number portability should be absorbed by recipient network?**

NeuStar Comments: Number portability, as implemented in the U.S and Canada, followed two different cost recovery models. In Canada, the model employed was a cost causer model, which allocates all NP costs back to the cost causer. In the U.S, all NP costs are pro-rated among the regional participants of the NPAC region, thus harmonizing costs among all participants.

The key for a good cost allocation mechanism is to have very well defined rules with little ambiguity and that is easy to enforce.

In general, it is a good practice that NP costs are shared amongst all beneficial constituencies.

#### **14. Please share any additional information that you might have about number portability implementations in countries and jurisdictions around the world, and what we might learn from these experiences.**

NeuStar Comments: Leveraging what NeuStar has learned from our extensive, first-hand NP design, implementation, and operations experience, based on the studies done by various countries and the global trends, we would like to offer the following observations and recommendations:

- a. An ACQ-based, centralized database solution (a.k.a.: NPAC) is the best long-term approach;
- b. NPAC is the most economic NP approach in a long run:
  - i. Ensure neutrality and fairness amongst all competing telecom operators
  - ii. Least performance impact to the networks when porting volume grows
  - iii. Most efficient solution for all emerging, IP-based services (MMS, PoC, VoIP, etc), as well as CCS7-based services
  - iv. Best solution for challenges faced by onward routing (CLI, 2G-3G, etc.)
- c. NPAC can be used to streamline inter/intra-carrier operations:
  - i. Number resource sharing, re-distribution, and single number assignment
  - ii. Network/switch upgrade (e.g.: TDMA->GSM, 2G->3G)
  - iii. Network/Switch traffic engineering and load balancing
  - iv. Network/Switch maintenance and disaster recovery
- d. A light weight, standards-based, all inclusive NPAC is the most economic solution:
  - i. XML/HTTP interface
  - ii. API for operators' point of sales (POS), service order entry (SOE), and operating support services (OSS) systems
  - iii. Optional, shared pre-port validation and communications systems, local NP service ordering and management systems, and Service Control Point (SCP) functionalities to minimize operator-side cap-ex and op-ex
- e. A well-designed and operated NPAC could be expanded, in a phased approach, to a multi-functional, convergence clearinghouse to improve ROI and streamline operations for operators:
  - i. SMS/MMS Gateway and Exchange
  - ii. VoIP Gateway and Exchange
  - iii. Mobile Content Clearinghouse

- iv. Number Administration System
- v. Common Short Code Registry
- f. Select the most experienced, and proven NPAC implementer and operator:
  - i. Implementation schedule and cost advantage with proven NP platform
  - ii. Need implementation and operations experience from both NPAC (centralized database platform) and operators' point of views
  - iii. Leverage proven experience in defining Functional Requirements Specifications (FRS), Interface Inter-operability Specifications (IIS), Methods and Procedures (M&Ps), business rules and operations flows
  - iv. Need knowledge and extensive implementation/operations experience for voice, data, the convergence of voice and data, and the convergence of fixed and mobile
  - v. Ensure most positive user experience for mobile subscribers
  - vi. Ensure system's highest availability, reliability, and scalability
- g. Adopt transaction-based, clearinghouse business model:
  - i. No up-front cap-ex investment required from operators for NPAC and other shared functions
  - ii. Most competitive transaction cost, leveraging economy of scale and proven operating experience

## **15. Give your comments, with reasons, as to when number portability should be introduced in India?**

NeuStar Comments: The introduction of the ideal NP solution is a complicated and multi-step process.

From drafting and finalizing regulations and policies, to defining system requirements and interface specifications, to agreeing on business rules and porting flows, to selecting vendors and solutions, to design, implementation, deployment and testing of the NP system, to operations readiness and internal training, and to marketing campaign and user education/promotion, the process is a time consuming one.

The sooner India can begin addressing the issues and getting the process started, the better prepared and positioned it will be.

## 16. Should MNP be implemented progressively by service area or directly across the nation at one time?

NeuStar Comments: As mentioned under Question #3 before, in the US, while centralized NPDB and ACQ was initially chosen, a phased implementation approach was adopted based on geographical regions, which mirrored the seven Regional Bell Operating Territories (RBOCs, each with its own regional NPDB), Metropolitan Statistics Areas (NP is mandated in the top 100 MSAs first), and service type (FNP first and followed by MNP) were adopted and proven to be working very effectively.

Considering India's geographic/population size, market growth rate and diversity/regional nature, we believe a phased implementation approach with one selected long-term solution might be a more appropriate way to go.

As a neutral 3<sup>rd</sup> party with 10 years of hands-on NP design, implementation and operations experience (and lessons learned) in US, Canada and Taiwan, NeuStar would welcome the opportunity to work closely with TRAI, all operators, and other local constituencies to find the best NP solution with the most realistic implementation timeline that would be most suitable to India and beneficial to all stakeholders.

**17. What will be the effect, if any, on the different aspects of implementation if phased roll-out is adopted?**

NeuStar Comments: As stated above under Question #3, because of differences between various geographical service areas, a phased roll-out approach may be appropriate, provided there is a clear timetable and a coherent implementation plan.

The only possible impact is relevant to those CDMA (ANSI-41 based mobile system) operators in India. In order for roaming to work properly between different CDMA networks, they would all have to support Mobile Identification Number (MIN) and Mobile Directory Number (MDN) separation that is resulted from NP.

## APPENDIX -- NEUSTAR PROFILE

NeuStar, Inc. ([www.neustar.biz](http://www.neustar.biz), NYSE:NSR) is a leading provider of essential clearinghouse services to the communications industry and Internet service providers around the world. NeuStar operates directories that manage virtually all telephone area codes and numbers, and enables the dynamic routing of calls among thousands of competing communications service providers (CSPs). In North America, the network of every telecommunications service provider is either directly or indirectly connected to NeuStar's centralized clearinghouse, virtually every telephone call placed is routed using NeuStar's system, and every telecommunications service provider is one of NeuStar's customers.

Neutrality is NeuStar's defining characteristic. NeuStar is required, under FCC rules and orders establishing the qualifications and obligations of the North American Numbering Plan Administrator, National Pooling Administrator and North American Portability Management LLC, to operate its numbering plan, pooling administration and number portability functions in a neutral and impartial manner. NeuStar cannot favor a particular telephone service provider, telecommunications industry segment or technology or group of telecommunications consumers over any other. NeuStar's neutrality efforts are reviewed periodically by independent third parties. Every NeuStar employee, contractor, and board member must abide by the company's published, FCC-approved Code of Conduct, and also must comply with an extensive list of neutrality procedures and principles. NeuStar maintains complete confidentiality of all competitive customer information.

NeuStar's critical technology services meet the addressing, interoperability and infrastructure needs of CSPs. These services are used by CSPs to manage a range of technical and operating requirements, including:

- 1) Addressing: We enable CSPs to use critical, shared addressing resources, such as telephone numbers, Internet domain names, and Common Short Codes:
  - North American Numbering Plan (NANP) Administration
  - Allocation of telephone numbers by geographic location
  - Assignment of telephone numbers to Telecommunications Service Providers (TSPs)
  - Administration of area codes, including area code splits and overlays
  - Collection and forecasting of telephone number utilization rates by CSPs
  - National Pooling Administration
  - Telephone Number Pooling
  - .BIZ Internet Domain Name Registry Services
  - .US Internet Domain Name Registry Services
  - .CN and .TW Internet Domain Name Registry Gateway Services



- Common Short Codes
- 2) Interoperability: We enable CSPs to exchange and share critical operating data so that communications originating on one provider's network can be delivered and received on the network of another CSP. We also facilitates order management and workflow processing among CSPs:
- Wireline and Wireless
  - Number Portability
  - Order Management Services
  - IP Traffic Exchange
  - Identity eXchange Services (IP-based)
- 3) Infrastructure: We enable CSPs to more efficiently manage changes in their own networks by centrally managing certain critical data they use to route communications over their own networks:
- Network Management
    - Technology Migration
    - Network Optimization
    - Disaster Recovery
  - Connection Services
  - Service Order Provisioning
  - Public Safety and Security Services

Since 1994, NeuStar has been the company that the communications industry turns to for mission-critical services. NeuStar has demonstrated its reliability in managing large databases, consistently executing millions of transactions daily, maintaining confidential data, and enabling the secure exchange of network and business information to ensure interoperability between next generation networks.

NeuStar's services are backed up by our employees that have extensive telecommunications backgrounds and all are seasoned professionals who actively apply their knowledge, experience, and skills, directly or indirectly, to resolving the communications industry issues for the benefit of the industry. They have served on state public utility commissions, as leaders of industry forums, and have made significant contributions as active members of technical and engineering standards bodies.

The following examples demonstrate our ability to consistently meet the needs of the communications industry:

1. **North American Numbering Plan Administration (NANPA)**— Since 1997, NeuStar has been operating the telephone numbering registry for the North American Numbering Plan (NANP) as a public numbering resource, serving customers throughout the United States, Canada, Bermuda, and many of the Caribbean Islands.
2. **Number Portability Administration Center (NPAC)**— In April 1996, NeuStar was chosen to serve as the Local Number Portability Administrator (LNPA). In that role, NeuStar operates the call and signaling/routing registry for North America that allows customers to keep their existing phone numbers when changing local service providers. Since 1997, it has been relied upon by 5,000+ service providers to route over two billion phone calls every day.
3. **National Number Pooling Administrator**— In June 2001, the Federal Communications Commission's (FCC) Common Carrier Bureau announced that it has selected NeuStar as the National Thousands-Block Number Pooling Administrator. NeuStar serves as the designated entity responsible for administering thousands-block number pools by assigning, managing, forecasting, reporting and processing data that will allow service providers in areas designated for thousands-block number pooling to receive telephone numbers in blocks of 1,000.
4. **Taiwan Number Portability Administration Center (NPAC)** — In December 2004, Telecom Technology Center (TTC), along with 13 largest mobile and fixed operators in Taiwan, selected NeuStar as the exclusive turn-key solution provider to design, implement, deploy, support, and maintain the NPAC system for all telecom service providers in Taiwan. The NPAC will go live in October 2005, to enable mobile and fixed number portability services in Taiwan.
5. **Internet Top Level Domain Registry for .biz and .us** — In November 2000, the Internet Corporation for Assigned Names and Numbers (ICANN) selected NeuLevel, Inc. (a subsidiary of NeuStar), to act as the registry for the first business-centric TLD name on the Internet— dot-biz (.biz), which has been “on-line” since the fall of 2001. In September 2001, the US Commerce Department selected NeuStar to act as the registry for, and to “re-launch” the United States Internet country code TLD – dot-us (.us), which came “on-line” in April 2002.
6. **OSS Clearinghouse** — NeuStar's OSS Clearinghouse is based on a transaction type service bureau model that enables telecom OSS data interchange functionality. The Clearinghouse supports five products: Wireless Manager, Voice Manager, Data Manager, Access Service Manager, and CARE Service Manager. The Clearinghouse facilitates the data interchange of these products to and from telecom service providers and telecom customers across the entire industry.
7. **Common Short Code (CSC) Registry** — In August of 2003, through competitive procurement process, NeuStar was selected by the Cellular Telecommunications & Internet Association (CTIA) to design, develop, and operate the CSC Registry. Common Short Codes (CSCs) created a common addressing system for wireless data applications across all participating U.S. carriers. CSCs, for the first time, enabled marketers, wireless content and application providers to reach a mass-market audience. The Registry and the CSC Program, successfully launched in October 2003, enabled interoperability across wireless carriers, content and application providers, and ultimately end users.