Q. Technical

NeuStar's usTLD platform, including its component facilities, equipment, software, hardware, and related technology, has facilitated the delivery of exemplary services for usTLD stakeholders. NeuStar will use the same proven infrastructure to support the udTLD.

1. Technical Facilities

NeuStar operates and maintains a world-class registry infrastructure for usTLD. This infrastructure includes:

- Redundant Shared Registry System (SRS) data centers in ▮▮▮▮▮▮ and ▮▮▮▮▮▮
- WHOIS sites in ▮▮▮▮▮▮▮▮▮▮
- 10 nameserver hosting sites ▮▮▮▮▮▮ ▮▮▮▮ geographically dispersed for diversity

Highlights
• **Existing registry infrastructure deployed at multiple, geographically-separate data centers within the United States**
• **NeuStar's systems support a high-performance, high-availability, standards-compliant SRS**
• **NeuStar's systems provide a robust, high-capacity, dynamically updated DNS and WHOIS**

Our facility locations provide diverse network connectivity and appropriate network capacity necessary to effectively operate the registry with associated support and administrative functions, and also protect against natural and man-made disasters. DoC and the usTLD community greatly benefits from the highly stable, secure, and redundant NeuStar registry facilities.

We describe here how NeuStar's registry architecture, infrastructure and facilities combine to exceed the need of the usTLD for a stable, secure and redundant infrastructure solution. We address registry facilities including physical attributes and locations, network connectivity and capacity, and site security.

Registry facilities and locations

NeuStar's registry facilities consist of corporate and administrative headquarters, along with two redundant data centers and 10 nameserver sites to provide a reliable and secure registry service to registrars, DoC and Internet users. NeuStar's primary data center location in ▮▮▮▮▮▮ also houses the registry customer support and sales offices, as well as all software and hardware operational support personnel.

As shown in Exhibit B-1, NeuStar's redundant SRS data centers and nameserver sites are geographically dispersed, interconnected via redundant DS3 links (between ▮▮▮▮ and ▮▮▮▮) and a Virtual Private Network (between all other sites) to provide protection against natural and man-made disasters and other events. The present facility locations are provided in the following table:

NeuStar Registry Infrastructure

Registry facilities	Site location
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As described in Proposal Section B, Sub-section C.3.ii, we are recommending the addition of multiple international DNS resolution sites to further improve the redundancy, reliability, and scalability of the DNS. These sites receive replicated zone data while the reference usTLD data remains in the primary and secondary data centers in ██████████ and ██████████ .

The number and placement of our SRS data centers, WHOIS, and nameserver hosting sites allows NeuStar to commit to some of the highest service levels in the industry. By provisioning a large number of machines, appropriate bandwidth with room to quickly expand as load requires, and the geographic diversity of our sites, NeuStar is able to handle both normal and extreme volume fluctuations. In addition, we are continuously evaluating the possible addition of new nameserver sites based on normal growth as well as changes in the environment due to 'bad actors' who use carry out DDoS attacks.

[EXHIBIT B-1 REDACTED]

Facilities Description

NeuStar maintains stable, secure, and redundant world-class facilities. Each facility shares similar environmental and security attributes required to meet stringent support and service level requirements. NeuStar's SRS, WHOIS, and nameserver infrastructure is operated and maintained on a full-time basis by NeuStar personnel. The ██████ site houses a data center and NeuStar's customer support, and operations staff, responsible for the management and day-to-day operations of the registry.

All of our nameserver hosting sites (existing and proposed) are maintained in stable, secure, and geographically diverse co-location facilities, ███. All nameserver equipment in each of our nameserver sites is owned, engineered and maintained by NeuStar personnel.

Each SRS site is located in a modern, fire-resistant building that offers inherent structural protection from such natural and man-made disasters such as flood, hurricane, earthquakes and civil disorder. Each facility has an internal fire-detection system connected directly to the local fire department. Data centers receive an extra layer of protection by the use of ceiling-mounted sprinkler systems, and each equipment room is protected by a pre-action, fire-suppression system utilizing Inergen gas as an extinguishing agent. The key environmental factors at the SRS data center, WHOIS and nameserver sites are described below:

Given their geographic diversity, nameserver collocation facilities are more varied. A typical configuration is described in the table below:

Building Security

[REDACTED]

[REDACTED]

[REDACTED]

Network Connectivity and Capacity

[REDACTED]

Internet connectivity – SRS data center

[REDACTED]

Internet connectivity—nameserver site

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VPN registry management network

Each nameserver site is connected to both SRS data centers via an ████████████████.
Furthermore, ███████████████████████ connect the two SRS data centers. These links comprise
NeuStar's Secure Registry Management Network.

The links between the data centers are used for:

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The secure VPN between nameserver sites is used for:

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LAN backbone

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Summary

The aforementioned facilities and network infrastructure have been expanded periodically during
the present contract term and have served usTLD well. For the upcoming term, we are proposing to
add name server sites to provide further redundancy and stability. We also periodically review our
facilities and network connectivity to ensure adequate capacity.

2. Equipment and Hardware

The equipment and hardware on which the registry operates are a critical element to providing a high quality of service. If the systems are of poor quality, if they are difficult to maintain and operate, or if the registry personnel are unfamiliar with them, the registry will be prone to stability issues and outages.

NeuStar has been successfully operating a domain name registry for over six years; supporting over 190 registrars. We have built the infrastructure using best in breed systems and software.

Since NeuStar built its SRS in 2001, there have been advances in technology, many of which we have implemented as part of wider technology "refresh" programs. These programs included the replacement of all new hardware components of the SRS, WHOIS and DNS, as well as the network infrastructure.   This equipment now includes:

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[EXHIBIT Q-1 REDACTED]

3. Software

NeuStar will the use the existing registry software suite to deliver usTLD services during the upcoming contract term.

SRS

The NeuStar Shared Registry System (SRS) software, which has successfully supported usTLD since 2002, implements EPP, the industry-standard registry-registrar model for registration management. The operating instance of the SRS is the authoritative repository for all usTLD registrations (contacts and hosts), including the expanded space, the locality space, and kids.us. During the current contract term, NeuStar has invested heavily in the engineering of SRS modifications to support these varied requirements in a single SRS system.

For provisioning interactions with registrars, the SRS software supports the Extensible Provisioning Protocol ("EPP") standard as defined by the IETF RFCs 4930, 4931, 4932, 4933, 4944, and 3745. The SRS meets all IETF standards and will be updated as necessary to keep pace with any further updates to the EPP standards that will be deployed in the usTLD in a timely fashion.

NeuStar currently provides documented SRS EPP toolkit software in both Java and C++ to assist registrars in accessing the SRS. To provide even greater connectivity assistance to new and potentially inexperienced registrars we also provide a specialized technical certification environment. This environment consists of a "scripted" EPP server that returns default responses to properly formatted EPP requests.

The usTLD SRS is a "thick" registry system with a standard registration data model for such implementations. A thick registry centralizes the authoritative registrant and other contact data at the registry to provide stability and data consistency. To reiterate the value of the thick registry model, it has been recently proven in the gTLD arena where a prominent registrar has ceased business operations. Without thick data at the registry, registrants would risk losing their domain names.

As described above, the NeuStar SRS achieves part of its scalability by leveraging load-balanced servers. Consequently, the application software is architected accordingly, with the ability to transparently handle multiple transactions from varying sources. Additionally, the SRS includes mechanisms to support the dynamic update of DNS and WHOIS.
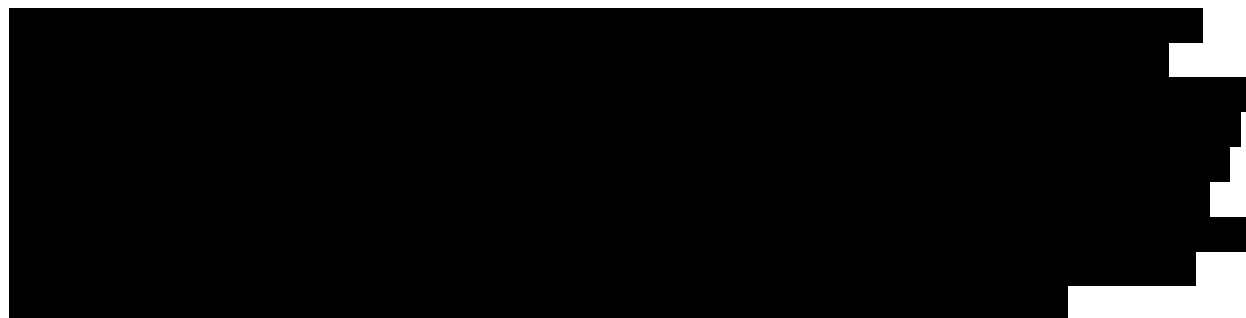
Other than the DBMS software, the SRS is custom software, supported by an experienced team of NeuStar software engineers, the majority of which have worked on the NeuStar registry since its inception in 2001.

DNS

███ ███ Throughout the present contract term, usTLD has had 100% availability of DNS ████████████████.

In addition to core resolution, NeuStar currently provides continuous, near-real-time zone modifications, distributed to geographically diverse locations, resulting in up-to-date responses from nameservers. As registrars submit changes in domain records, the system will reflect these in the zone almost immediately. ██ ███

As with any registry data modification, each registrar wishing to change, add, or remove DNS information uses standard EPP commands or the Registrar Administration Tool. All such changes require appropriate authentication, passing of business rules/edits, and permissions. Additionally, in emergency circumstances, NeuStar registrar support can affect changes to the data on behalf of the registrars.

As the NeuStar DNS infrastructure is based on dynamic update technology, the zone is not "generated" in the same way as in traditional batch-oriented file-based approaches to DNS. ████████ ███████████████████████████████

In this fashion, the zone data actually reaches the resolvers more quickly because it does not need to go through the intermediate step of zone file generation. While the data publication mechanism is not used, the data being sent is completely standards-based. The NeuStar DNS infrastructure provides data that is sends the data for all manner of DNS record types including SOA, NS, A, AAAA (IPv6) records. In addition, it supports MX and CNAME records to provide DNS for the Locality space.

The NeuStar DNS solution is a robust proven mechanism of distributing the data across a wide network. NeuStar has configured its network with a variety of redundancies so as to further ensure reliable zone distribution

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WHOIS

The NeuStar WHOIS service is built upon a sophisticated architecture that optimizes the constraints of query performance, dynamic updates, and flexible configuration. A key feature of the architecture decouples data distribution from query services.

The query capability is provided by a service that operates on the WHOIS servers, listens on port 43, and supports the standard WHOIS protocol. ████████████████████████████████████ ████████████████████████████████████ Additionally, WHOIS includes a web GUI. In order to maintain consistency of results, the WHOIS web GUI queries the WHOIS service (via port 43).

The WHOIS service came to usTLD with the launch of the expanded space. (Prior, there was no centralized WHOIS.) Simultaneously, we launched a dynamic update capability for WHOIS and have operated in this fashion throughout the current contract term. The WHOIS has since been expanded to include all usTLD locality-based structure domains.

NeuStar's dynamic update architecture uses a workflow that decouples the update process from SRS transactions. ████████████████████████████████████ ████████████████████████████████████

Architectural components are as follows:

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NeuStar's WHOIS is provided via command line (port 43) at whois.nic.us as well as via web interface at www.whois.us.

During the upcoming contract term, we will utilize our existing WHOIS software and will modify as needed to support evolving requirements.

Specialized Web-based Tools

In addition to the aforementioned software components, our registry software portfolio also includes a number of specialized web-based tools. These tool are either unique to usTLD or are extensively modified to support the unique aspects of usTLD.

Registrar Administration Tool – NeuStar currently provides a secure web system (the Registrar Administration Tool, "RAT") that provides web-based access to the SRS, allowing registrars to easily manage domains, contacts, and hosts through a series of web screens. The tool allows registrar personnel to process transactions for themselves without needing to contact Registry Customer Support, which saves time for the registrar and enhances productivity. The RAT interface has been modified to support usTLD-specific processes, for example, kids.us and Nexus requirements.

Delegated Manager Tool – As part of our responsibilities under the current contract, we have built a web-based tool to allow a Delegated Manager (DM) to manage domains under its control.   The DM Tool   is a simple web site that provides a means for DMs to manage WHOIS and DNS changes in real time.   Through this tool they are able to manage nameservers and contacts associated to their domains without having to go through a manual request to customer service.

Kids.us Content Management System – Allows kids.us registrants who would like to launch a kids.us website a way to request content review. A registrant first requests a content review through www.kids.us by purchasing an annual subscription. This subscription then starts the regular review of the web site to ensure that it is in full compliance with the policies of the .kids law. Assuming that the content review passes the first check we then allow the domain name to resolve in the DNS.   If during regular reviews we find a violation, then a warning is sent to the registrant. If the problem is rectified there is no impact to the domain name. If not then the domain name is take out of DNS and therefore the web site is brought down. All existing policies can be found at http://www.kids.us/content_policy..html.

Each of these applications, while seemingly familiar, has a particular nuance that bears careful inspection to fully understand.

4. Related Technology

While the previous sections have focused on some of the core technologies, we take the opportunity here to describe some of the other technology investments that we have made during the usTLD contract term.

Data Warehouse

The Data Warehouse is a central data repository used to create both internal and external reports, primarily to support registrar billing and contractual reporting requirements for DoC. For billing reports, the database is updated incrementally 4 times daily, then supplies those updates to the

████████████████████, which provides billing information for the registrars. For DoC reporting, daily full backups are copied to the reporting database to perform report queries on a monthly and daily basis, per contractual requirements.

Billing and Collection system

NeuStar's proven experience in successfully operating complex Billing and Collection (B&C) systems for communications and domain name registry services ensures that our usTLD registry billing services are feature-rich, accurate, secure, and accessible to the entire customer base. The B&C system maintains customer accounts, creates account statements, and audit and tracks information for both customers and the industry.

The fundamental goal of the system is to maintain the B&C data and create reports that are accurate, accessible, secured, and scalable. B&C enables detailed transaction-based charging to the customers, based on extensive resource accounting and usage data recording performed in the Registry System. The B&C system must produce timely and accurate account statements and billing reports that are accurate, easy to understand, and contain only clearly defined charges from the catalog of services and prices. Such account statements are ultimately more economical because they are less likely to provoke costly billing disputes.

NeuStar offers a simple B&C process that is based on debit and/or credit card accounts established by each registrar. We withdraw all domain registration service payments from the incurring registrar's debit or credit card account on a per-transaction basis. We provide fee-incurring services (e.g., domain registrations, registrar transfers, and domain renewals) for customers only so long as their accounts are in good standing. NeuStar's B&C system is sufficiently flexible to adapt to different billable events, grace-period implementations, and pricing structures.

NeuStar's B&C system are located at ██. These systems handle the key B&C functions, including:

- Debiting and crediting registrars' accounts,
- Initiating low-balance notifications,
- Performing credit card transactions,
- Enabling customers to view their accounts, and
- Tracking and reporting historical information.

Our B&C systems and processes are fully compliant with Sarbanes-Oxley (SOX).

Website

NeuStar currently maintains a web portal for registrar use. This secure portal provides a variety of services and information that includes:

- Operational notifications for planned maintenance or upgrades;
- Operational updates on incidents such as degradations or outages;
- General registrar business notices;

- Registrar Operations Guide;
- Frequently asked questions (FAQ); and
- Client toolkit downloads.

██████████████████████████████ The home page of the web portal includes notices to registrars of planned outages for maintenance or installation of upgrades. These notifications are posted 30 days prior to a maintenance event, in addition to active notification including phone calls and email to the registrars. Finally, 7 days and again 2 days prior to the scheduled event, we use both a Web-based notification and email to remind registrars of the planned outage.

5. Summary

As described above, NeuStar has a wide array of technical facilities, equipment, software, hardware, and related technology. As much of this technology has already been extensively customized for the unique and critical elements of usTLD, it represents a portion of our investment in the TLD. Additionally, since NeuStar is leveraging a proven, existing platform, there is no transition risk.