Revised Proposal of Frequency Finder, Inc.
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In re
ET Docket 04-186
DA 09-2479
OET Invites Proposals from Entities Seeking to be Designated TV Band Device Database Managers

The following is a slightly revised proposal in response to the OET Order in DA 11-131. Several typographical errors were found and fixed, and cooperative efforts underway in several organizations are now reflected in the wake of this order conditionally designating nine DBA's. The undersigned is designated as the responsible party as required in paragraph 19 section 2. Frequency Finder, Inc. ("FFI") further designates Mick Harkins as an additional representative for OET workshop participation should the undersigned be unavailable. FFI will cooperate with any steps OET deems necessary to ensure compliance with the rules, and agrees that it will not use its capacity as a database manager to engage in any discriminatory or anti-competitive practices or any practices that may compromise the privacy of users.

FFI, in cooperation with Mountain Tower, Ltd., d/b/a RadioSoft and other corporate entities under its umbrella, hereby proposes to be named a database manager, and to fulfill all the requirements set out in the Second Report and Order FCC 08-260 released November 14, 2008. FFI is fully qualified to operate and maintain a TV Band Device ("TVBD") database and conform to any and all emergent requirements of a multiparty solution.

Qualifications of FFI

FFI was formed by the principals of RadioSoft, among others, in 1999 to create software for frequency assignments based on FCC and ITU Rules and has been both wholesale and retail database and coordination service provider to Part 90 applicants since 2000. RadioSoft has been processing FCC databases since 1981, and has supplied third party FCC data queries online since 1987 for Parts 22, 73 and 74 and since 1991 for Part 90. Its software is in use at the FCC itself, by all major Television Networks in the USA and elsewhere and by much of the Federal Government. It processes CDBS and ULS data from FCC daily into multiple formats for online and downloadable delivery, and provides 24/7/365 reliability to thousands of users. Moreover, as one of three signatories to the "70-80-90" 3PDBM Memorandum of Understanding between FCC, NTIA and the three parties, FFI is already a designated database manager[1]. Its authority was renewed in December 2009 for a second five year period.

[1] see: http://wireless.fcc.gov/services/index.htm?job=service_home&id=millimeter_wave

Database Architectures

FFI (with RadioSoft) has extensive experience with SQL database architectures, including implementations by Microsoft and PostgreSQL. Additionally, it has created its own proprietary database, optimized specifically for FCC data structures, which far outperforms all other such systems, with inimitable query response times. Given the expected volume of queries, FFI expects to provide, through its experience, an architecture with both high performance and flexible interfaces that best meets the demands of various internal and external systems.

Multiparty

As it did in the 70-80-90 debate, FFI believes that permitting multiple parties will achieve the greatest efficiency in development and economy. In the 70-80-90 3PDBM system, all functions are integrated, and all three DBMs, along with NTIA, share link information laterally using the SOAP protocol suggested by FFI and implemented by all. This system has operated over the nearly five year initial period in a quasi-real time sharing environment. It presented only minor implementation challenges at its outset and has remained stable, secure and effective ever since. The specifics of that lateral interchange were jointly developed between the 3PDBM members. In the current matter, negotiations are actively underway between the nine conditionally named parties to develop interchange and transport solutions.

Business plan

FFI in cooperation with RadioSoft has sufficient experience and resources on hand to construct and maintain all of the proposed services for a period of five years or more, without depending on revenues. FFI expects to have comparatively modest development, hardware, bandwidth and maintenance costs as a result of proven, efficient business practices, and therefore expects to be able to provide TVDB database services at very competitive rates. Fee structures can be matched to best suit the type and volume of services desired, and fees will be collected as usual by credit card, purchase order, or other means of payment.

Database implementation

FFI proposes a database implementation to fulfill all the requirements set forth in Sections 15.713 and 15.715 of the Rules, a general overview of which is provided in the diagram at the end of this document. The FFI implementation shall consist of three working groups: a backend accessing FCC databases and providing registrar services for protected entities, a data storage and manipulation facility to process and store all requests to be handled by the implementation, and a front-end which communicates directly with white-space TVBDs.

Design principles

The implementation is designed to provide superlative reliability, redundancy, and security on multiple levels. Data flow is managed within the system such that each external entity accesses a service that only “sees” data which that service is intended to provide to that entity. Components within the implementation shall recognize only well-defined communication with one another, minimizing damage in the unlikely event of unauthorized access. All lateral and front-end links may be encrypted to protect sensitive data from wiretap attacks. Reliability is ensured by the use of multiple redundant systems

within the implementation, and geographically disparate failover sites operating in parallel to prevent downtime due to Internet outage or environmental disaster.

Back-end systems

The back-end of the proposed TVBD database is already largely implemented by FFI, consisting of clients to FCC CDBS and ULS servers currently in daily use. These, along with redundant servers to handle requests for protection for CATV headends, wireless microphone operators, and TV translator receive operators, shall constitute the back-end of the FFI TVBD database implementation. Information collected by back-end components shall be manipulated, stored, and shared laterally (i.e. to competing FCC-authorized TVBD database administrators) by the internal data and manipulation storage components of the implementation.

Data manipulation and storage

With the anticipated volume and functionality of TVDB devices, any TVBD implementation must maintain a higher standard of reliability than even the FCC's ULS or CDBS. Therefore, each implementation of the TVDB database maintained by FFI shall include a central data repository based on a Redundant Array of Independent Disks consisting of solid state device (SSD) disks, a technology that has proved to be far more reliable and provide greater bandwidth than traditional magnetic media. Additionally, a congruent fail-over system shall operate at all times in parallel with the primary repository to provide redundant service to front-end and lateral data services in the event of sudden multiple disk failure. The central repository shall interconnect with front-end and lateral services via high-bandwidth fiber-channel or 10GbE (or higher) links.

The central data repository shall store three categories of data:

i. Calculated TV Rules data
ii. TVBD registration data
iii. A shadow copy of all back-end data

TV Rules data shall be the product of calculations operated by a dedicated component ("Rules"), on data collected by back-end services (FCC databases and entries from protected entities), consisting of geographical boundaries of protected channels, for the purposes of tabulation by the front-end and service to TVBDs as specified in §15.713 (d).

WSD registration data shall comprise all information provided by registered TVBDs as specified in §15.713 (f) and (g), supplied to the repository by the front-end registration server.

The repository shall additionally maintain a shadow of all raw data provided by back-end services, updated daily, ensuring continued service in the event of prolonged interruption of back-end communication due to Internet outage or failure localized to the FCC (or other parties).

All TVBD registration data maintained by the repository shall be made available in quasi-real time via the proven SOAP protocol (or other protocol as agreed by the White Space DBA working group "WSDBA") to FCC designated third parties and alternate failover sites maintained by FFI, over existing Ipv4/v6 networks, and encrypted using SSL/TLS, IPsec or other protocol as agreed by the WSDBA. FFI will also make available a wholesale, account-based high-speed data service to any FCC designated third parties desiring to provide query and/or registration services.

Front-end systems

The two functions of determination of available channels and TVBD registration shall be carried out by the front-end servers of FFI's TVBD database implementation. Both the Query Server and Registration Server will communicate directly with TVBDs and interpret requests for channel lists and registration. The Query Server, reading geographical data from a TVBD client and rules data from the Central Repository, will return a list of channels to the client in a manner compliant with §15.713 (d) of the Rules. Likewise, the Registration Server will handle requests from fixed TVBDs to register in the TVBD database in the manner specified by §15.713 (f).

Flexibility

FFI's proposed implementation of a TVBD database is designed to provide flexibility anticipating the proliferation of registered TVBDs into the millions of units. With the internal structure here proposed, additional storage, front-end and back-end servers, and external bandwidth can all be scaled to meet demand with zero downtime, no degradation of performance, and very little outlay beyond the cost of hardware. The organizing principle behind FFI's database implementation, developed over 27 years, will allow it to provide services to all 50 U.S. States, Territories and Possessions.

Detailed Database function description

Typical architectures are:

ULS

Server	Purpose
ftp Granted Weekly	ingest, process, validate and error notify FCC raw License files
ftp Granted Daily	ingest, process, validate and error notify FCC raw License files
ftp Pending Weekly	ingest, process, validate and error notify FCC raw Application files
ftp Pending Daily	ingest, process, validate and error notify FCC raw Application files

When validated, data is sent to initial Granted and Pending ULS database servers, where it is backed up and separated into segments by purpose and band for distribution to "live" servers, of which there are currently six sets in two database formats, one proprietary for high speed querying and one SQL.

CDBS

Server	Purpose
ftp CDBS Daily	ingest, process, validate and error notify FCC raw Broadcast files

When validated, data is sent to initial CDBS database servers, where it is backed up and distributed to "live" servers, of which there are currently three sets in two database formats, one proprietary for high speed querying, one SQL and the third (for TV records only) to replicate the FCC's OET-69 interference calculation processes.

Wireless Microphones

These are quasi-real time SQL servers which allow account-verified customers to notify dates, times, frequencies and locations where they expect protection from TVBD devices via Internet. A simple browser-based interface as well as a local customer database-enabled batch transfer program for third parties will be used.

Cable Television Headends

Headend locations, desired receive channels and CDBS facility ID numbers (there might be more than one possible TV facility for any given location and channel) will be stored, and all TV facilities whose protected contour encompasses each headend location deleted.

Protected Part 74 TV receive antennas

Since TV Translator and related receive antennas are not sufficiently well described in CDBS, these will have to be inferred to populate a database subject to correction by licensees. Again, a simple browser-based input form as well as a user database-enabled program for batch filing will be provided for third parties.

Rules Server

This server will have as input all the protected device locations, and will apply White Space Device rules in Part 15 to each to define a protected area by channel.

Central Data Repository

This server has a TV channel availability list by channel for each geographic location for all land area of the USA and its territories. Its input is from the Rules server, and outputs to the Query Engine. It also maintains data on Registered TVBD's so that the Registration Server may validate channel requests. It is highly optimized both in hardware and software to permit requests to be returned immediately.

Query Server

Its input will be from the Internet by TVBDs and in batch from wholesale accounts. It will parse the input data, validate and return query information from the Central Data Repository.

Registration Server

For new fixed (Mode II) TVBDs, it will parse and validate data from the Internet from the devices and in batch from wholesale accounts. It then adds validated registrations to the Central Data Repository.

Lateral Services

The Lateral Services servers will in quasi-real time:
i. Send validated Mode II registrations received by FFI to other third parties as specified by the WSDBA
ii. Receive the same from them
iii. Receive, validate, parse and return channel query information from wholesale designated entities, and
iv. Receive and respond to requests from FCC for device-wide "no-channel" requests.
Lateral Services will also provide for internal offsite backup, failover and other redundant emergency servers.

TVBD communication and authorization protocol

The communication and authorization process for TVBDs will conform to all the requirements set forth in §15.713 and provide for expanded fields as new applications and technologies emerge. Anticipating a large number of TVBDs in simultaneous operation nationwide, this proposal assumes that the method of access by TVBDs of the TVBD database services will depend on the IPv6 network protocol. FFI will nonetheless support any or all devices remaining on IPv4 networks. TVBDs will communicate with TVBD database services using three types of communication protocols. The cases of fixed (or Mode-II) and Mobile (Mode-I) devices in motion devices acting on their own behalf are straightforward. However, the case of Mode-II devices relaying query requests on behalf of Mode-I devices or other Mode-II devices

under §15.711 (f) exposes the TVBD database to various types of exploitation. FFI thus recommends the use of blind encryption such that the channel list to be relayed may be neither read nor altered by the relaying device. This may be accomplished by the combined use of hardware-based mutual authentication systems in TVBDs utilizing, for example, secret keys known only to TVBD database administrators and hardware manufacturers, and transport-level data encryption. This issue is under discussion at the WSDBA.

Conclusion

FFI, by virtue of its varied and long-term experience in both TV and Land Mobile database management, is particularly well qualified to be designated a Database Administrator. Should the popularity of TVBDs require a more accurate model of TV channel availability such as is exemplified in the Satellite Home Viewer Act, FFI has a coded and proven implementation of Longley-Rice which is arguably the fastest in the industry. This could significantly improve the bandwidth available in and around urban areas without compromising the required protections, and do so effortlessly due to its unusual database architecture and with performance comparable to that possible under the current Rules.
While the Commission and the parties to the White Space Coalition have made admirable progress in defining and enabling the TVDB service, the technology must be permitted to develop without being constrained unnecessarily by large vested software budgets and the political inflexibility which inevitably accompanies them. Founded in 1981, FFI is a woman-owned rural small business with the ability to economically code, test and adapt to any imaginable variety of processes needed by newly developing applications for these technologies, and has the expertise to graft them onto the global marketplace with partners and connections in every corner of the world should it become possible. It is both exciting and crucial that receivers generally be better protected as spectral density increases, and FFI intends to stand squarely in that nexus.

/s

Peter Moncure, Vice President
Frequency Finder, Inc.
February 28th, 2011