WHY IMPLEMENTING PEER TO PEER IMAGE TRANSFER *CAN* BE PAINLESS

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I. TELERAY BACKGROUND

Market: TeleRay Inc ("TeleRay") is a software company providing a universal distribution and management platform for radiological images, diagnostic data, and patient data worldwide. In addition to the professional healthcare market, TeleRay also provides patient/consumer-centric image access services such as BebeVue for prenatal ultrasound - see www.bebevue.com

Mission: TeleRay will deliver high-value services that meet medical professional and patient/consumer requirements with full regulatory compliance. The TeleRay platform will become the largest exchange for radiological images, and the most data-rich repository of clinical information. The TeleRay ecosystem and data will be the most valued for use by the medical community of providers, insurers, patients and researchers worldwide.

History: Founded in 2007 in Chicagoland, TeleRay is managed by senior professionals in healthcare technology and business. The company is privately funded and benefits from an extensive Advisory Board comprised of leaders and experts in healthcare, technology, and business.

II. TOP TEN PAIN POINTS IN CHOOSING A CLOUD IMAGE TRANSFER VENDOR

1. Security/HIPAA
2. Speed
3. Ease of Use/Features
4. Implementation/Flexibility
5. Credentialing
6. Universal Formatting
7. Patient Data
8. Support
9. HIE and Other Options
10. Cost

When contemplating the important move to cloud-based image distribution, it is critical to consider the planning process as a first priority. Users must be comfortable that the move from familiar film, CDs, DVDs and flash drives will involve a seamless transfer of workflow and simple adoption to reinforce their confidence that the right decision has been made and thereby gain their support. If the new technology is cumbersome, difficult to understand and implement or, worse still, creates a new set of responsibilities, the move will likely fail. The planning process must include input and approval from the Users, PACS Administrators, Technologists, IT, Radiology Management, and C Suite Executives; satisfying the requirements of each will eliminate conflict and produce the results desired by all. Therefore, analyzing the pain points for these stakeholders in the migration plan is a critical component of understanding and heading off potential future challenges.

Pain Point 1- Security and HIPAA.

These issues are linked as the number one concerns for moving to cloud based image transfer when confidential patient records are involved. Stories of serious data breaches at retailers and banks - who should have the best security available – are almost daily news fodder today. These breaches are depressingly common for perhaps very surprising reasons. First among these is the almost universal use of HTTPS - a 25 year old security technology. Of course not all old technology is bad; after all, millions of people still listen to AM radio or use pencil and paper, but if a chosen technology creates serious systemic risk, it is time to move to more advanced and secure solutions in mitigation. Despite this, *HTTPS remains the standard for most cloud image transfer companies for the upload and download of patient studies*. Since HIPAA provides for criminal prosecution for a data breach it might seem short-sighted, to say the least, to rely on such technology to keep doctors and executives out of jail.

There are *many* ways to break into HTTPS/TLS/SSL today, usually by compromising one of a relatively few Certificate Authorities or hacking servers to gain access to email to break domain validations, even when websites do everything "right". As currently implemented, the Web's security protocols may be good enough to protect against attackers with limited time and motivation, but they are inadequate for a world in which geopolitical and business contests are increasingly being played out through attacks against the security of computer systems with meta-processing capability that can create any number of key permutations and combinations to access sensitive data.

Securing patient data that is moving from facility to facility, facility to patient, and once beyond the walls of the institution, could be going anywhere, requires a daunting effort. Administrators are adding very cumbersome protocols to try and *control* the data but still failing to *secure* it. Adding levels of credentialing, approval and management of the network does nothing to secure the *transfer* of data. Worse still, most of the time, the administrator will not even know who is actually storing their incredibly sensitive patient data since a cloud company may offer storage as their own but then sub contract another vendor to provide it.

In addressing these critical issues, available technologies that give the best options for secure transfer without sacrificing user experience on either end should be considered. Some companies offer Private Key or Closed Certificate systems which, based on their encryption methods, cannot be defeated even by the NSA and are listed as Munitions Grade Security by the US Government as a result. While current HTTPS websites will allow anyone to see their certificates and gain half the information needed to hack the site, a private or closed system creates a new and random key each time an exchange is going to take place resulting in a highly secure transfer.

Prior to encryption, patient information should be compressed to add another layer of security by default since the receiver needs to have the same algorithm to decompress the information. The transfer channel should also be encrypted for multiple layers of protection creating an impenetrable transfer of data only achievable via a peer to peer method. This method transfers data directly from sender to recipient on a client or hardware-based solution *upon request from the receiver*. The cloud is only used as a transitory transfer medium; unlike "conventional" transfer systems, critical data is not stored in the cloud and exposed to hackers.

The recent scare where a Jeep was taken over remotely by hacking into its onboard navigation and diagnostic software on a California highway was solved utilizing a peer to peer hardware recognition system, thereby foiling any possibility of hackers creating havoc on the road. So seriously is this being taken that Mary T. Barra, CEO of General Motors, announced in October 2015 that such peer-to-peer counter-hacking measures are being developed under tight secrecy for implementation on GM vehicles as of that date.

Pain Point 2- Speed.

In the medical arena, where seconds can make a crucial difference in outcomes and even life or death, the right tools need to be at the clinician's fingertips without delay. For a trauma patient bleeding out, the time waiting for film or a CD to be burned before being dispatched to a waiting MediVac or OR could represent a lifetime; patient outcomes can be greatly improved by getting images to the ER/OR before the patient even arrives.

Compression was mentioned above as an important security component, but it also increases speed. For example, depending on network performance, up to ten minutes in transfer time could be saved by compressing a 100mb study to 10mb before sending. Therefore, lossless compression on fast, client-based systems where bandwidth and latency issues would otherwise affect transfer speed, ease of use and efficiency is a critical element to consider in planning a system change. How fast does the information move from one point to the other?

Speed is also important in other less obvious areas such as managing and credentialing users. Accessing cloud services should not be a time consuming and cumbersome process - see pain point 5.

Pain Point 3- Ease of Use/Features.

"Quick start" guides exist for everything from lawn mowers to high-end electrical equipment. Most product users don't want to wade through pages of user instructions to understand the technical wizardry making a product work, preferring to rely on ease of use. Clinical users are no different; they demand simple, intuitive steps to achieve the task at hand. Therefore, when planning a system implementation, the following should be considered:

1. Workflow features should be accessible in single, clear user interface. Toggling between applications, widgets or applets to perform a standard function such as importing a disc, scanning a document or film, anonymizing etc is cumbersome and time consuming and may create other technical issues.

   On as related note, many vendors separate basic features as part of their revenue strategy. Some features that may seem insignificant today may be needed after implementation; a situation the vendor can then leverage to overcharge for required "upgrade" licenses. Gaining an understanding *all* the products and features relied upon by users for daily activities such as document and film scanning, anonymizing, web access, QC viewer, data masking, tag editing, importing, DICOM study and image format correction and many other essential daily tasks is recommended to avoid falling prey to such predatory license practices.

2. User training required should be minimal to none. If an interface is appealing, inviting to use and encompasses all aspects of daily workflow, a user should be able to approach the application and complete tasks without reference to a help menu or manual. Overly technical interfaces can be intimidating and difficult to navigate even for the most experienced user, let alone a temporary staff member or locum. By utilizing macros within the software there is no excuse in modern systems for clunky file driven menus requiring multi-level hunt and clicks to perform simple tasks that simply increase learning curves and generally waste time. Thoroughly "test driving" applications to ensure all required features are present and easily accessible for users will save a lot of post-implementation time and trouble.

3. Even the most efficient and well maintained networks can become slow or even crash with heavy usage. Bandwidth and system latency can significantly affect the efficiency of modern image management systems. A client-based approach should be considered to overcome these poor experiences since the tools are not dependent on utilizing network resources until a study is sent.

Pain Point 4- Implementation and Flexibility.

Easy implementation and low cost are two of the key reasons for moving to the cloud and so should be just that- easy and low cost. Unfortunately, most sites that have implemented cloud transfer technologies have experienced neither. Cost will be discussed specifically in pain point 10 but in terms of pure implementation, getting an interface in front of multiple users to exchange images on a network is intuitively straightforward. After all, most computer users have logged into a website or used an application and uploaded a file to save or transfer to another computer – so what could possibly go wrong? The complexity of an implementation should be carefully considered and the following specific issues addressed:

1. Is the upfront cost for implementation and training on a per user basis and if so, what are the implications when adding and training a new user? Additionally, the cost should be based on the actual intended use of each user with no artificial volume limits for those either within or outside the confines of the site. A system should be able to accommodate everyone without excessive fees or restrictions - paying excessive costs to link up to a website and training is not cost effective.

2. The implementation and training process should be quick and seamless, whether relating to a user from day one or added a year later.

3. The system should be sufficiently flexible to meet the needs of any user at any specific time. It should allow user access to all features all of the time and vary cost only by usage. For example, if a neuro only needs to send 4 studies a month out to another specialist, his *total* cost should be no more than the $4 for the transfers in a given month.

4. Payment options are an important aspect of implementation and flexibility. A true pay-per-use model allows for cost to be treated as an operational rather than a capital expense. There should be no subscriptions, minimums or annual contracts to meet.

5. The time required by a vendor for an implementation project should be reasonable and allow for adequate internal resources to be allocated to accommodate it.

If small / underserved users exist within the institution and outside of the network then complete flexibility and fast, simple implementation is critical.

Pain Point 5- Credentialing.

There are two major credentialing issues to consider in any new implementation, being (i) the administration requirements for adding/deleting users and managing passwords and (ii) the user sign in process. There are systems that allow users to credential themselves into a broad reach enterprise connected to multiple institutions. This type of system allows the potential for many more users in the surrounding medical community without someone to limit the power of a self-credentialed system. The decision over who should or should not be included as a user in a closed network is usually based on cost since VPN and PACS access from OEMs can be expensive. However, in a self-credentialing system, those issues disappear.

Typical PC users are now so used to signing in over and over again it's easy for them to forget what it is like to simply open Outlook and get mail. Outlook has the option of logging into the program each time it's opened, but most users choose not to because the computer they are using it on already has login access control. Similarly, in the healthcare world, HIPAA has made credentialing and the tracking of who was on a system a serious matter but it *does not* mandate multiple log-ins each step of the way! Systems that give access to programs, including transfer programs, based on the computer user's login security save time and aggravation.

Pain Point 6- Universal Formatting.

There is much hyperbole surrounding systems offering Vendor Neutral Archiving ("VNA") capability. VNA provides the capability to read, review and restore any type of image, document or digital information regardless of format, whether it be medical (e.g. DICOM) or not (e.g. jpeg, PDF etc). This premise is great at the point of distribution, but not so much if the format is not accessible when the images or file is received somewhere else. This problem exhibits itself most commonly in healthcare in the exchange of images and patient data such as reports. Equipment manufacturers create many problems - sometimes by design for competitive reasons – or otherwise the image format simply has tags, pixel data differences, improper file set readers or other problems which render the file un-restorable and therefore unreadable.

Formatting can become a life and death situation in the cases of a trauma patient. If a CD or cloud transfer cannot be restored, the patient must be rescanned losing precious minutes. Even in non-critical situations, the rescan will often expose the patient to unnecessary radiation and will not be a reimbursable procedure, therefore adding significant cost of care. Many systems can move a native OEM formatted study to another location through the cloud, but if it can't be restored by the receiving end, *nothing has been accomplished*. This has been an accepted measure of some transfer systems and it should not be acceptable when lives, quality of care and extra cost are considered.

Some systems overcome this problem by recognizing formatting problems at source and stripping them out to create a truly universal format when sending to another site or professional. To be a true exchange or transfer service, universal formatting is a must.

Pain Point 7- Patient Data- EMR/EHR.

Patient data is produced from disparate HL7-based EMR and other systems that enjoy significantly less compatibility than DICOM systems because DICOM is the only truly universal format in global medicine. Having access to patient data beyond that included with a typical imaging study provides a more holistic understanding of the patient and ultimately leads to better clinical decision making and outcomes. Some systems on the market are capable of searching for patient data from EMR's and other systems and display it in HTML for universal viewing. This is especially helpful in the transfer of data since all computers have some type of browser to display HTML data. Currently about 80% of patient data files don't include the images, thereby making them incomplete; such DICOM based systems overcome this by delivering *both* images *and* other available patient information that may affect a clinical decision.

Pain Point 8- Support.

Choosing a vendor in a new sector can be daunting when trying to understand the credibility of a technology and the company's ability to provide technical support and customer service. Great technology generally requires low levels of support, but if it's new and the use of it is still being developed, there will be more dependency on support. Many new "cloud" vendors repurposed some other type of transfer technology without understanding the nuances of DICOM, HL7 and most importantly the clinical environment in which they reside. Without a thorough understanding of the clinical workflow environments, it is difficult to implement, support and build technology to meet the demands of medical imaging especially in an environment of rapid clinical and compliance change. Vendors that have been in the arena for an extended period of time and have delivered full enterprise solutions are favored in this space. It is a sensible to seek references at major institutions that have been through the process and experienced both the vendor's technology and the support that went with it.

Pain Point 9- HIE and Other Options.

Health Information Exchanges ("HIE's") provided by local governments as an independent third party are good ideas in principle. In some regional cases they have succeeded at certain levels by, for example, demonstrably reducing cost and rescans. The primary goal of an HIE is to provide a higher standard of care through the sharing of images and data and initially the cost is picked up by the State, which is a big boost to local savings. However, as with all State run programs and offerings, they eventually begin to fee users to cover cost. As they become larger, these programs become a tax and a revenue program for the State once dependency is established. Some other considerations regarding HIE programs:

1. Encryption and Security Methods. These can be expensive and need to be kept up to date. Without proper maintenance and technology, the data is unsafe. HIPAA encryption requirements from over fifteen years ago are too low for today's standards, leaving users exposed unless they self-advocate for stronger security.

2. Interoperability. This too can be very expensive to maintain and keep up with changing technology and requirements.

3. Mobile. Is using mobile secure? Who and what is at risk?

4. Storage. How secure is the data with backups and data integrity?

5. Private Information. It has not been determined yet to see who has access to private information on public HIE where employees could search data such as venereal diseases or terminal cases that could be leaked to insurance or the press.

6. No one can do everything. There are many issues that HIEs won't be looking to resolve from features to interoperability at a specialized clinical level.

These are just a few issues to consider an all the previous pain points apply to HIEs as much as any other vendor. Most non-profit or State run programs end up lacking in the area of support, whereas the support to the clinical environment – whether related to implementation or a random question - simply can't be left to wait. When an HIE is run and supported in the same manner as the DMV or Post Office, you may want to have alternatives!

Pain Point 10- Cost.

One of the most critical metrics of moving to a cloud based exchange system is the cost involved. While important, the previous 9 pain points *must* be considered before looking at cost. When trying to solve a problem, cost becomes secondary or even irrelevant if it is not getting resolved. So after examining the above, the financial and economic considerations are as follow:

1. Effect on IT cost
2. Capital expense and operational budgeting
3. Staffing requirements
4. Hardware requirements
5. Security costs (insurance)
6. Fees
    a. Monthly fees
    b. Storage fees
    c. Transfer fees (sender and recipient)
    d. Minimums- monthly & annual
    e. Cost for "upgrade" features or options
    f. Hidden fees
    g. Support fee

Many promises of delivering a study for a dollar have been found untrue. Recent analysis at a site utilizing cloud transfer systems were actually paying more than $14 per transfer once all fees were accounted for. The fine print justifies costs and hidden fees that would obviate the economic value of a move to the cloud. Pure pay-per-use or fee-limited models are worthy of consideration, especially in the beginning stages of implementation.

The cost of keeping a referring physician satisfied can become a serious problem if the right solution is not presented. Engaging specialists and referring physicians with a transfer system that eliminates many of their problems is tantamount to success. Once the basic costs are understood, a plan can be executed to begin the move to the cloud both within a site's VPN and external to it (e.g. physician's offices) without the pain.

III. TELERAY SOLUTION

TeleRay - The Next Big Thing in Healthcare Information Technology:

TeleRay new professional software launched with highest level private key munitions grade security system for transfer of data.

Next-generation image management and sharing system; complete market disruptor utilizing Peer-to-Peer Image Exchange Network.

Device agnostic- access, exchange and view images with an FDA approved viewer on any device at any time.

Single price structure with no hidden or extra fees. Prices quoted are for unlimited use.

TeleRay – Feature and Market Benefits:

Industry-first free software download; zero capital acquisition cost for users, eliminates budgeting cycles.

Finally enables access to image management and sharing across the entire spectrum of medical offices, hospitals, clinics, and remote workers; all medical disciplines, specialties, and imaging diagnostic work.

No capital budget requirements, no hardware, no cost barriers, self-enrollment and credentialing.

Full compatibility and compliance with all DICOM (the only universal standard file format in healthcare IT) imaging hardware/systems.

Eliminates need for CDs and other physical media, enabling instant image sharing between any users anywhere in the world with zero loss of image data/integrity.

Decoupling of image management software from imaging systems, provides truly universal solution.

Protected via a portfolio of intellectual property including security, image compression and transfer methods, and conversion of medical images to non-medical formats for consumer markets. US Patent No: 6,856,975/File 61/815,291- 61/815292- 13/153,036- 13/152,964- 13/152,964- 13/152,964- 61/429,116- 11/893,663.

Economical for any and every health care provider, equally economical for all specialties and disciplines.

Reduces direct cost per image versus traditional methods by 50-90%

Provides interoperability between all imaging systems.

Eliminates image transport errors and losses; avoids rescheduling, treatment delay and re-scan.

Reduces insurer and provider costs of patient re-scanning.

Provides added efficiencies to Telemedicine.

Incorporates class-leading compression and security; ACA and HIPAA compliant.

Provides simple self-enrollment – with self-credentialing, enrollment integration with Doximity.

Eliminates need for I.T. involvement in install and setup.

Improves patient experience & outcomes.

Unlike "cloud" solutions, is workflow compliant, and carries no minimums and extraneous fees.

Enables Data Analytics ("Big Data" applications.)

IV. HEALTHCARE INDUSTRY – Direct and Indirect Cost Savings, Benefits & Efficiencies

Market adoption of TeleRay solutions will create direct cost savings in the delivery of healthcare. Many savings, such as dramatic reduction in - and eventual elimination of - physical media (CDs) and patient re-scan costs, are direct and calculable. Efficiencies such as reductions in time, labor, and error rates represent imputed cost savings in the system. Overall, benefits of adoption of TeleRay solutions drive down costs while increasing quality and "bandwidth" of the practice of healthcare. Several key benefits include but are not limited to:

- Avoidance of treatment deferral, expedited emergency / life-saving treatment
- Regulatory compliance, avoidance of financial penalties (HIPAA, ACA, Meaningful Use etc.)
- Improved patient outcomes, reduced radiological exposure
- Value of consistent patient education and avoided costs of maintenance thereof
- Value of improved patient experience and engagement/compliance
- Improved workflow, reduced clinical downtime
- Telemedicine efficiencies
- Analytics (Big Data applications) for accurate patient history, research and optimal diagnosis

V. PRODUCT DEMONSTRATION

TeleRay will gladly provide a live Web session to demonstrate the services described herein, and to address any questions and comments, or to generally discuss how we may assist you.