Customer case

The VNA in Region Stockholm is paving the way for the future of enterprise imaging

> The main benefit of BFT is that it provides one joint platform for storing and consuming all medical images across various healthcare providers.
>
> *Gustav Alvfeldt, IT Solution Owner of Medical Imaging, Region Stockholm*

Many healthcare providers are currently adopting enterprise imaging systems to facilitate collaboration and increase efficiency in the sharing of medical images. Although not many have reached full "multiology"-based adoption yet, there are a few examples that have made good progress and that others can learn from. Region Stockholm in Sweden, one of Europe's largest healthcare providers, is such an example. Since 2016, Region Stockholm has successfully been using a cloud-based and region-wide vendor neutral archive (VNA) connecting public and private health providers, which has significantly improved and streamlined the sharing of medical images. We recently met with four key individuals involved in the birth, set-up and future development of this project, and asked them to share their experiences and recommendations with others on the same journey towards full enterprise imaging.

SECTRA

Knowledge and passion

> Being able to compare the current image with prior images can be lifesaving for the patient.
>
> *Johan Henriksson, Consultant Radiologist, Director of Medical Imaging, Söder Hospital*

Interviewees:

- Johan Henriksson – Consultant Radiologist, Director of Medical Imaging, Söder Hospital (SÖS)
- Fia Westman – Radiology Manager, Ersta Hospital
- Kristine Andersen – Operations Developer, Ersta Hospital
- Gustav Alvfeldt – IT Solution Owner of Medical Imaging, Region Stockholm

Stockholm—a highly fragmented healthcare region

Stockholm is the capital of Sweden and the largest county when it comes to population. It also has the highest spending on healthcare in general and per capita (2019)[1]. Healthcare services in Stockholm are mainly (70%) government funded, while the other 30% are connected to private actors and clinics[2]. In total, there are over 2,000 healthcare providers in the region—ranging from hospitals and primary care to specialist clinics and private dentists.

This highly fragmented healthcare landscape puts high demands on collaboration and sharing of medical images from various disciplines. For many years, the region suffered from inefficiencies in this workflow, leading to high costs due to a large administrative burden to manually look for and send images—not to mention a vast amount of unnecessary examinations. To address the problem, Region Stockholm went out to tender for a region-wide VNA, a solution they called "BFT"[3], which was later implemented in 2016. This joint multimedia archive has since significantly facilitated the sharing of medical images and multimedia across the region.

Today, BFT enables both public and private providers to efficiently share images across a range of different ologies and is continuously being developed into a world-leading enterprise imaging system.

A previous workflow full of inefficiencies

The previous workflow created a lot of frustration among both physicians and patients. Johan Henriksson, Consultant Radiologist and Director of Medical Imaging at Söder Hospital, who worked as a radiologist at the time, explains:

"Earlier, the communication of medical images, and radiology images in particular, was inefficient. It involved burning and sending CDs or using teleradiology to route image studies around. In parallel, fax machines were used to send the associated reports in a separate workflow."

Gustav Alvfeldt, IT Solution Owner of Medical Imaging at Region Stockholm and one of the originators behind BFT, describes the previous workflow as a "spaghetti workflow" where images were routed around among providers in an unstructured and inefficient manner. He continues:

"Images were stored in different PACS at each provider, completely isolated from each other. Radiologists had no overview of what patient information and previous images were available. We estimated that approximately 100,000 unnecessary radiology exams were performed annually, partially due to this incomplete patient overview. Not only did this create a lot of extra costs for the region and inconvenience for patients, it also exposed patients to more radiation than necessary."

Johan continues by describing the workflow from a clinical perspective:

"To get access to prior examinations, which is paramount in radiology diagnosis, I first needed to guess or look into several different administrative systems to find out which other providers were likely to store relevant images for my current case. Then I had to send a request to those providers asking for the specific images. This process took a lot of time and required detailed knowledge of what to ask for. Not to mention the administrative work required on the part of the providers whom I asked for the relevant images."

Gustav describes how each provider had secretaries responsible for the task of finding, preparing, routing and sending images.

[1] https://www.dagensmedicin.se/artiklar/2017/09/07/har-ar-varden-dyrast-i-sverige/
[2] https://sv.wikipedia.org/wiki/Sjukv%C3%A5rd_i_Stockholms_l%C3%A4n
[3] BFT is an abbreviation of "Bild- och funktionstjänst," which translates to "Image and function service".

> The biggest strength of BFT is that it includes images from both private and public providers.
>
> *Gustav Alvfeldt, IT Solution Owner of Medical Imaging, Region Stockholm*

In total, it was estimated that Region Stockholm had more than 20 full-time equivalent (FTE) employees to manage the administration of radiology images alone. He concludes: "This workflow was just inefficient, expensive and not patient safe."

In total, the inefficiencies in the pre-BFT workflow created strong incentives to unite politicians, care providers and IT solution vendors to find a common solution.

The introduction of BFT

After a tender process in which Sectra was selected to provide a centralized VNA, BFT was up and running in 2016. Its main purpose was clear: to enable all healthcare providers to use a single archive for storage and consumption of all medical images. This was a necessary step in order to increase efficiency in the communication of multimedia and to provide a full patient information overview for physicians.

All of our interviewees agree that once the decision was made, there was no major resistance towards implementing the system. Fia Westman, Radiology Manager at Ersta Hospital, explains:

"One of the keys to get everyone moving in the same direction has been the coordinating unit for BFT. This group included representatives from many different providers and ologies from the very beginning. Together, these representatives shaped and developed the prerequisites for how providers could connect and join BFT. It was based on the core foundation that they pay for the services they use."

Johan Henriksson, Consultant Radiologist, Director of Medical Imaging, Söder Hospital (SÖS)

Kristine Andersen, Operations Developer at Ersta Hospital, was highly involved in the operative implementation of BFT. She highlights the benefit of using "internal champions" to promote BFT from within. "These people could be an experienced radiologist or someone the staff listened to. They made implementation much simpler."

Transferring hundreds of users to a completely new IT system was a big change. Johan and Gustav both emphasize the need for such projects to start small and show early benefits in order to ease the transition. "We quickly created interest among users to become part of the system. Today, we still see providers asking to join once they learn about the possibilities," Johan says.

A cornerstone for the successful implementation was to both take a "bottom-up" and "top-down" approach, involving both users and a central coordinating group in decisions regarding prerequisites.

The experienced benefits of a region-wide VNA

Since 2016, Region Stockholm has continuously developed BFT to include more providers, adding more functionality and increasing the number of ologies. So how is BFT working today in comparison with its intended use? Johan explains:

"BFT is doing what it is intended to do—it has significantly improved the communication of medical images. Its benefits are experienced by a range of specialists as it provides healthcare professionals with a complete patient overview. For provider organizations, it reduces most of the previous administrative work. Overall, the solution we have today is much less expensive than the previous situation and workflow, provides more patient information and is more secure in terms of uptime and patient integrity."

Both Fia and Johan highlight its positive impact on the workflow. Johan explains:

"We have seen a major positive impact on the workflow. BFT allows patients to smoothly move between public and private clinics, and from diagnostics to treatment, since it makes sure the medical images are always accessible to all physicians

involved. Because of the large number of providers connected to the system, it facilitates complex care pathways and makes them more efficient than before. Images flow seamlessly between large hospitals, primary care clinics and small orthopaedic clinics."

> "BFT has allowed us to secure diagnostics on a completely new level by giving access to all relevant patient data."
>
> *Fia Westman, Radiology Manager, Ersta Hospital*

There is a consensus that BFT has achieved what it was meant to do from the beginning—improve the workflow, enhance patient safety and reduce costs. The VNA is still being developed to include more ologies and streamline the diagnostic workflow across providers. But the journey to date has not been without its challenges.

Challenges encountered along the way

The implementation of BFT required a big change, both in terms of IT infrastructure and how the entire healthcare apparatus was organized in the region, but specifically it meant a different way of working for many users. All medical images and patient histories already stored in various PACS across the region needed to be migrated to BFT. This involved numerous considerations when it came to how to handle such issues as duplicates, missing patient information, damaged files, etc. Many different IT vendors needed to collaborate, and providers were required to agree on a more standardized way of working in order to solve the migration.

As one of the BFT originators and visionaries, Gustav knew that many of these challenges needed to be resolved during the implementation.

"The limitations we faced have either been technical or organizational. For example, a lot of time and effort was spent on solving the technical debt from consolidating images from all the various PACS in the region. Handling exam duplicates has been a big issue. To solve that, we used inbound tag-morphing and restriction rules.

"When it comes to organizational limitations, we have made progress but still have a way to go to harmonize the various examination codes used between the different providers," says Gustav. As an example, he mentions he discovered that the various providers had 27 different ways of naming the same kind of exam for staging rectal cancer.

> "We have achieved a full patient overview and significantly enhanced communication among all providers in the region, while also improving the economy."
>
> *Fia Westman, Radiology Manager, Ersta Hospital*

Johan describes the handling of revisions and changes to exams as another major challenge.

"One might think an exam works like a Google document, where everyone can add annotations to the same file and where it is possible to see who has made each change. But in healthcare, stringent regulations restrict the use of such technology for creating a fully transparent overview. The implementation of imaging object change management (IOCM)[4] is a step in the right direction, but many details are currently not handled by IOCM. That's where we had to be innovative and find workarounds together with Sectra."

Kristine mentions that some of the challenges encountered related to the configuration of access control rules. "It became obvious that providers interpreted the regulations differently," she says. "We had to find a new method to create, manage and give access rights that didn't exist before, while adhering to all existing patient privacy laws."

Fia mentions that although the BFT coordinating unit laid out the economic prerequisites from the beginning, a lot of questions have been raised related to the financials of joining BFT. "We faced questions and new exceptions all the time about who, how and when a provider is to pay for using the service. Should it be based on storing images, consuming them, or both?"

[4] IOCM is part of the Integrating the Healthcare Enterprise (IHE) initiative and specifies how one actor is to communicate local changes applied to existing imaging objects to other actors that manage copies of the modified imaging objects in their own local systems.

> Find politically powerful champions inside the organizations who can act as messengers. Bring in someone external to introduce new ways of thinking.
>
> *Kristine Andersen, Operations Developer, Ersta Hospital*

Fia continues by saying that the financial question is tricky because it is partly a political decision that they have to comply with. "It is up to the governmental political organ in the region, Hälso- och sjukvårdsnämnden (the Public Healthcare Services Committee), to sign agreements with various providers and agree on fee levels."

Although many of the challenges were known from the start, and some surfaced along the way, all of the interviewees highlight the importance of working closely together with Sectra and other stakeholders to find solutions.

> The project had a broad scope from the beginning, starting with radiology and then adding other ologies.
>
> *Gustav Alvfeldt, IT Solution Owner of Medical Imaging, Region Stockholm*

On the journey towards full enterprise imaging

Gustav explains that the ambition was high from the very beginning when it comes to including all kinds of medical images. The starting point, however, was radiology only. To date (March 2020), BFT has expanded to include the following medical specialties and types of examinations:

- Radiology
- Breast imaging
- Clinical physiology (heart and vessel ECG)
- Cardiology (primarily ultrasound)
- Dermatology
- Mammography
- Nuclear medicine
- Non-DICOM: reports and measurements

BFT is continuously being developed into a full enterprise imaging system by adding other ologies and types of multimedia. Some ologies that are under investigation, in the pilot phase or on the way to being included are:

- Hospital photography
- Digital pathology
- Surgery (photos and videos)
- Endoscopy

"A prerequisite for creating a 'multi-ology' system that is also future-proof is to follow standards. That has been one of the main cornerstones from day one," says Gustav. Headmits that in some disciplines, the lack of standards has been challenging. Gustav explains their approach in those scenarios:

"To store non-DICOM images in BFT, we often use DICOM wrapping or keep the original format using XDS[5]. Storing non-DICOM images in a standardized format makes the system future-proof."

Johan gives a few examples of ologies that lack DICOM, such as endoscopy and ophthalmology, which store images in many various proprietary file formats and different IT systems. "These are challenging to add to the system but both we and them see the benefit of doing so," says Johan.

On the journey towards full enterprise imaging, the VNA needs to act as a common archive for the majority of ologies involved in patient pathways. The three key benefits of such a system mentioned by the interviewees are:

- Having a single storage architecture and a single point of integration
- Making image and data viewing simpler
- Reducing or eliminating future data migration costs

[5] Cross-Enterprise Document Sharing (XDS) focuses on providing a standards-based specification for managing the sharing of documents between any healthcare enterprises.

> There must be financial incentives for providers to connect to and use the service.
>
> *Fia Westman, Radiology Manager, Ersta Hospital*

The decision to buy BFT as Software as a Service (SaaS)

BFT was purchased as a "cloud-hosted service". Sectra was thus selected as the single full-service provider to deliver the software, third-party software, network and hardware necessary to run the VNA. According to Gustav, the service business model has both pros and cons:

"The biggest advantage is having 'one throat to choke', meaning that we only need to deal with one party. This makes everything much easier."

Fia experiences the same benefit, but also mentions that it is important to ensure the contract can evolve to include necessary functionality as needs change. "It is important to know what you're getting and have efficient processes in place to make sure you can add new functionality to the contract as our needs change with time," she says.

Gustav and Johan are very keen to implement new functionalities and AI-based technology into BFT. This is a development that will require a close dialogue with Sectra as a full-service provider. "Because of Sectra's full responsibility, including the system availability, any additions of third-party applications to BFT need to be agreed upon and carried out together with Sectra," says Johan.

> The times change, the world changes. As such, the service must change.
>
> *Kristine Andersen, Operations Developer, Ersta Hospital*

Gustav explains further:

"Sectra guarantees the uptime of BFT through strict service level agreements (SLAs) connected to fines if they cannot be met. This is an insurance we can give to the connected providers and a major benefit of the service model. To keep this advantage of a SaaS delivery, we engage in a close dialogue with Sectra as to which applications are appropriate to integrate, since these applications might jeopardize the system's uptime."

From Sectra's perspective, Region Stockholm was at the forefront when they decided to purchase BFT as a SaaS. Based on the benefits created by allowing healthcare providers to refocus on their core business—providing patient care, not IT—there is now a clear industry trend towards buying IT systems based on full-service contracts.

The future

Today, Region Stockholm is at the forefront when it comes to enterprise imaging and utilizing a single region-wide system for all medical images. Looking to the future, they see many areas where BFT can further contribute to better patient care and research within the region.

"Having one joint image archive containing all images and patient information offers huge potential for the future," says Johan. For example, he mentions that BFT has the potential to contribute significantly to research by allowing for data withdrawals of images produced by many different providers and different modalities. He adds: "This becomes especially valuable since the images are linked to patient information and outcome data from the electronic medical record, EMR."

Johan also explains the potential of implementing AI. "The collected data in BFT is a goldmine for training and implementing AI and for providing applications such as business analytics. We can analyze patient flows and behaviors, research utilization, predict workloads, etc., all of which can help us understand and optimize our operations at a completely new level."

Gustav Alvfeldt, IT solution Owner of Medical Imaging, Region Stockholm

Looking ahead, Gustav mentions the potential of starting to apply AI to the image data within BFT to analyze pixels in the images instead of using metadata. “This kind of ‘smartness’ could allow cases to be prepared before specialists receive them, such as highlighting potential findings, which would save significant amounts of work and reduce the risk of errors.”

Johan also explains how he believes BFT could be leveraged by connecting it to central registries: “We can use BFT to enforce national or regional guidelines, such as report templates that need to be automatically populated for a specific examination type or finding.”

Kristine and Fia both see a future in which BFT can reduce the number of IT systems required by each provider and instead run the systems centrally. “This would reduce costs and the administrative burden considerably,” Fia says.

> “Providers see the potential to reduce the number of IT systems and to save actual money.”
>
> *Johan Henriksson, Consultant Radiologist, Director of Medical Imaging, Söder Hospital*

Top advice to others

As the interviews come to an end, we ask what advice they would give to other providers about to embark upon a similar journey. Their responses were surprisingly similar.

- Build the requirements in terms of workflow demands by using real-life cases. Do not base requirements on technical details. The technical details are up to the vendor to solve. Be solution-driven.
- Involve people from various functions in the organizations concerned from day one and get bottom-up commitment. Consider the different clinical organizations, different ologies and IT.
- Establish a coordinating unit that can set the prerequisites for joining the system (top-down governance).
- A good workflow can only be achieved through a close partnership and dialogue between users, IT, the coordinating unit and the IT solution vendor.
- There must be financial incentives for providers to connect to the system. The clinical organization needs to see short-term benefits for joining. Benefits that can be shown include cost reductions in terms of archives and staff, improved workflows and increased productivity.
- Find influential and knowledgeable ambassadors from the different operations. These people will lead their colleagues and reduce any resistance to change.
- Make the system future-proof by using standards such as DICOM, IHE and HL7. For example, the IOCM profile allows the VNA to handle updates to the various PACS solutions in the region. Do not base requirements on theoretical models that might not work in real life.
- Providers must let go of protecting their data. The best solution for the patient is if providers share images with other providers in the region.
- Take it one step at a time—or, as the Swedish saying goes, “Eat the elephant in small pieces”. Start with one step and show progress. The projects that fail are those where you try to accomplish everything at once.

Lastly, Johan finishes by saying:

“Be persistent and open to new ways of thinking—that’s the way to succeed with a change like this.”

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