

White Paper

Quality Assurance of Medical Displays through an Online Service

What's inside?

- Softcopy QA today
- ASP applied to softcopy QA
- MEDICAL QAWEB features and benefits

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ABSTRACT

Most PACS display systems from specialized vendors come with various forms of integrated solutions to perform Quality Assurance. These solutions are workstation based and hence are only able to control calibration and QA on one local reading seat. Aggregating the QA performance on a level of the facility through central management is realized by extra software tools. These tools require an upfront investment for the medical facility. Although the payback of such tools can easily be proven if all indirect savings are taken into account, the capital investments still create a substantial threshold in their acceptance and market proliferation.

Delivering remote QA management tools under the form of an application service provider ASP business model through an online central server seems a very logical step forward and addresses the major drawback for acceptance of these tools.

This white paper highlights:

- caveats of the current softcopy QA process
- the benefits for every stakeholder of this new concept
- how HIPAA compliance and security concerns are addressed using web based services.

PREREQUISITES

This white paper highlights new aspects of the softcopy QA process and assumes that the reader has a full understanding of the DICOM Grayscale Standard Display Function (GSDF). Also it should be clear that there is a major difference between calibration and quality assurance.

These topics are discussed in another white paper "Why is softcopy QA important?"^[1]

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CHAPTER 1: SOFTCOPY QA TODAY

Quality Assurance on the level of the workstation

With the introduction of PACS came a need for consistent calibration and quality control for medical displays. Medical QA guidelines like AAPM TG18 and DIN6868-57 were established to quantify and control the quality of medical displays. Over the past 3 years, softcopy QA awareness and usage has grown substantially. The majority of large medical facilities in the US, Japan and some parts of Europe (Germany, Austria, Scandinavia, Holland) have quality assurance programs in place managed by one or more individuals (QA technologist, radiology manager, etc.).

Since this evolution, reliable, powerful softcopy QA tools have been implemented by display vendors. This revolution has gained success due to the switch of CRT based displays to Liquid Crystal Displays. LCD displays contain an embedded front-of-screen optical sensor for luminance control and stabilization. This technology enables softcopy QA tools to run intervention-free. Combining this with central management makes softcopy QA affordable for a medical facility.

Beware that these reliable, powerful QA tools do not come for free. They provide the necessary reports, notifications and asset management according to the guidelines. A real, trusted DICOM GSDF compliance check can only be done with an accurate built-in front sensor, a device that shows every actual measurement and its compliance to the standard curve. Today these QA tools are partly bundled with the displays, and partly sold as standalone package for central management, notifications, etc. This will be clarified further in this paper.

Quality Assurance on a facility level

There are a number of obvious reasons why QA on the workstation level only is not sufficient:

- o QA staff needs to physically access all reading workstations spread over the facility site(s) to execute and check for valid calibrations and successful QA checks. Central management will reduce their workload and will also improve their work planning.
- o More and more facilities move to a multi-site concept. Remote QA is the only feasible solution to get a global picture of all calibration and QA activity.
- o Central management, automated preventive maintenance and proactive issue notifications validate the savings and ROI of central QA tools (as an investment). These are highlighted by the business cases discussed in another white paper, "Why is softcopy QA important?"^[1]

This central management application (e.g. MEDICAL Administrator) is currently sold in different fleet sizes (e.g. for controlling a maximum number of workstations). This is a capital investment for the facility. Applying and being compliant to the local guidelines introduces another extra cost: the plug-in QA tools enabling you to generate the right reports proving the compliance.

Realizing softcopy QA in a medical facility requires a major investment. A responsible person must be allocated, an implementation plan should be in place and resources need to be assigned. These resources are not only people (QA technicians still doing the manual work), but also the IT infrastructure (central workstation with a data integrity and maintenance plan).

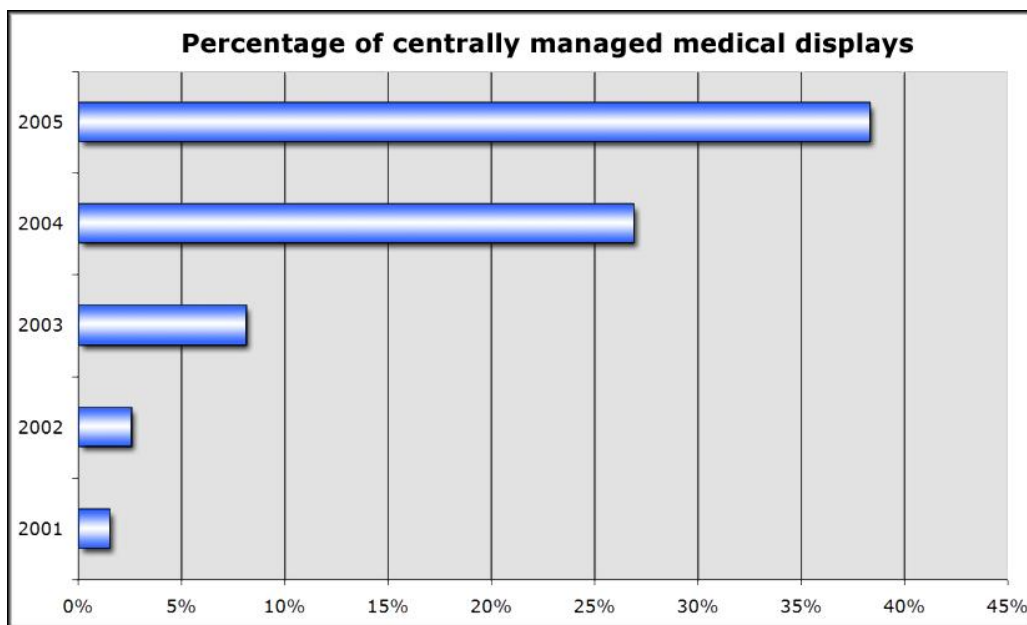


Fig. 1: The percentage of medical display centrally managed grows rapidly year after year (based on sales data from Barco and Frost & Sullivan).

The success of softcopy QA can easily be measured by quantifying the percentage of centrally managed displays in a medical facility. Fig. 1 shows this was still less than 5% before 2003. It really took off that year and by 2005 nearly 40% of the medical diagnostic and reviewing displays were connected to a central quality management system.

Although the QA awareness is growing rapidly, still upfront investments are necessary for the dedicated QA tools. This triggers an extra threshold for these investments to be approved. Let's look at the details based on the currently shipping products.

MEDICAL Pro - MEDICAL Administrator – Extended warranty option packs

The existing MEDICAL product line, together with Barco's service options, provides a great solution to the customer today. Automated QA, customized notifications and advanced reports are key benefits of these products. However, from the hundreds of medical facilities already using this today, we have learned a lot.

From these experiences we were able to improve the tools by regularly releasing new updates resulting in a smoother workflow for QA and service technicians. However, there are some major, conceptual changes necessary to generate enough new benefits for every stakeholder. Also the PACS workstations are evolving, operating systems better support remote activity, security concerns are getting under control and software deployment becomes easier.

These are only a couple of reasons why the new MEDICAL QAWEB concept enters a new level of flexibility to the end user: you pay per display per year for QA and service, with a minimum labor cost and maximum workstation uptime. More details are explained in the next chapters.

A logical bundle of QA and service

Softcopy QA tools are partly bundled with the hardware: they allow calibration and control of the graphic board and display so the systems are compliant to DICOM GSDF. You always have to pay for central QA management; these are sold as separate software packages to be installed in the medical facility (e.g. MEDICAL Administrator).

They enable extra features like notifications, reports, remote actions, etc. Currently, service options on display hardware are sold separately and cover a number of years. Both the QA tools and the service options are capital investments for every PACS implementation or upgrade. These two investments fit very well: the QA tools notify a local QA person about a possible display issue, the issue is identified and a fast replacement is necessary. So the QA initiates the service action and once a new display is installed, the QA tools will again take care of the initial calibration and further tracking.

Current capital investments for QA and service

The central QA package is a capital investment. That's obvious. But also a lot of extra, hidden costs are popping up:

- IT has to assign a workstation for installing the central QA software. They also have to configure, test and maintain the system
- IT is responsible for the data integrity of all central QA data. It also controls the reports and proper installation of the system, so this still takes some time.

- For qualitative software you pay a yearly maintenance fee so you get the latest patches and updates; sometimes new functionality provided by upgrades are an additional cost
- QA technologists using the tools still spend some time diagnosing possible issues from the system; this involves manual troubleshooting.
- Once the system is installed, reports can be created and manually distributed. The responsible QA person still spends some time on this.

Also the initial service (for the coming 3 years for example) is an investment. It mostly includes solutions to replace a defective display in a fast and efficient way so the workstation uptime is maximal. A loaner display involves labor cost of uninstalling the bad display, shipping it, locating and retrieving a replacement display, installing it and re-initializing the calibration and quality assurance. During that time, the workstation is unavailable for diagnosis.

CHAPTER 2: OFFERING SOFTCOPY QA BY USING AN ASP

What is an Application Service Provider?

An Application Service Provider (ASP) hosts a variety of applications on a central server. For a fee, customers can access the applications that interest them over secure Internet connections. This means that they do not need to purchase, install and maintain the software themselves; instead they rent the applications, the application server, storage infrastructure and the associated system management from the ASP. The application runs at a data center (Fig. 2). The company offering the service can remotely control the application deployed and multiple users connect, run and exchange information to and from the application.

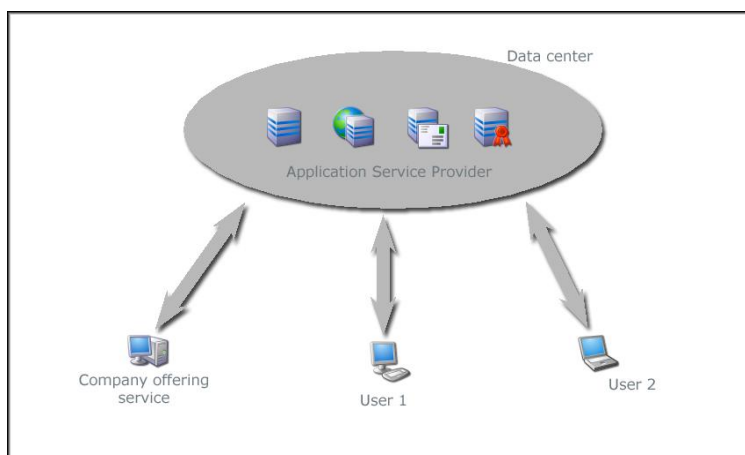


Fig. 2: The basic concept of the Application Service Provider business model

The ASP business model was introduced in 2000. Predictable service levels and costs, stability, faster application deployments, reduced need for capital, and reduced need for IT staff are all compelling reasons behind the explosive growth of the ASP industry. An example in healthcare is the PACS archiving where customers pay per study. But in the mean time ASP has evolved into different sub-models and is implemented in every medical facility worldwide.

Easy deployment is an important benefit of ASP: versions are centrally managed and a visitor can easily download the latest version. The application functionality can be remotely hosted. Central tracking and reporting becomes easy. These features result in a more reliable solution for the end user.

Also the scalability is controllable. The licensing model can be flexible and the bandwidth and central application load can be scaled according to the number of users and the network traffic. Moving to an ASP also limits the IT infrastructure and workload for the end user, so less administrative work is required.

But most of all the ASP decision is taken because no upfront investment is required. We can further review the details in the context for softcopy QA.

Investment versus ASP for service and softcopy QA

Let's compare the investment in the current service options and softcopy QA and the ASP business model for a medium-sized medical facility (e.g. 20 diagnostic displays) over a typical period of five years.

Investment	ASP business model
<ul style="list-style-type: none"> ✓ <u>Upfront investment</u>: warranty and service conditions for a period of 3 years ✓ <u>Upfront investment</u>: software license for central QA management ✓ Labor cost: general QA management by using the tools ✓ Labor cost: manual troubleshooting and supporting interventions ✓ Extra cost for service options for the 4th and 5th year 	<ul style="list-style-type: none"> ✓ No surprises: you pay a <u>fixed amount per display per year</u> and can plan this in your annual budget ✓ In the occurrence of a possible issue, you have a very fast solution on hand ✓ Thanks to the advanced features of MEDICAL QAWEB (those will be explained in depth in the next chapter) the labor cost will also decrease: <ul style="list-style-type: none"> ○ You will no longer have work on the manual distribution of updates/upgrades ○ The tools are optimized for every user, so the general QA management will be minimum ○ The on site visits will be reduced, the shipping costs will be less, all thanks to single swap options of color matched displays and advanced remote troubleshooting (color matching of multi-head display configurations is important for radiologists).

With MEDICAL QAWEB and its ASP model a medium sized medical facility will reduce the QA and service cost by more than 10% over a period of 5 years.

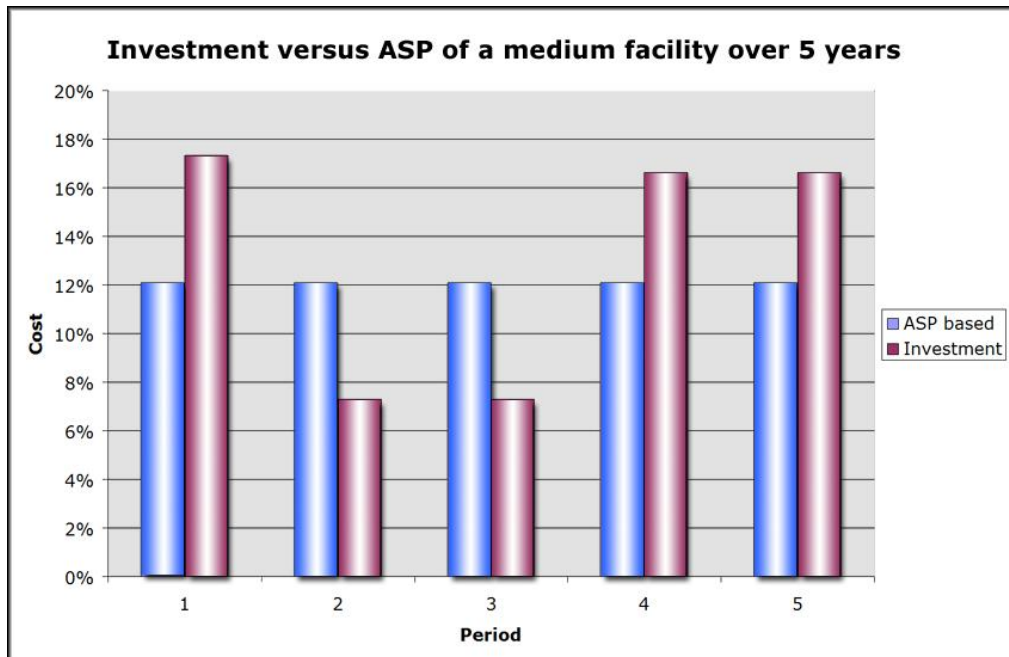


Fig. 3: Investment versus the ASP approach: after 5 years the cost through ASP is about 10% lower than investing in QA and service options

CHAPTER 3: SECURITY CONCERNS FOR ONLINE SERVICES

The Internet boom has made life easier for a lot of people and especially for the medical imaging industry. In the last two years the benefits of this technology have overcome the security concerns. Device management and remote support are commonly installed features in healthcare.

For remote connections, it is important to mention that the National Electrical Manufacturers Association (NEMA) has published a recommendation for remote servicing [2]. It recommends a Secure Remote Servicing Information Technology Architecture to be used in healthcare.

It also relates to the Health Insurance Portability and Accountability Act (HIPAA), an organization focusing on the protection of Personal Health Information (PHI). [3]

MEDICAL QAWEB is fully compliant to both references. It is based on a secure remote connection mechanism and also provides all tools and options to comply with the HIPAA regulations.

Communication over the Internet with MEDICAL QAWEB is fully encrypted and uses strong authentication based on Public Key Infrastructure (PKI). The data contains device information of the equipment supported, but does not transfer any patient or medical workflow related information. To ensure that no security breaches will occur, you have full access to a logging trail on the central access point of MEDICAL QAWEB to the Internet. The technology used for MEDICAL QAWEB is based on state-of-the-art security concepts. It is based on current security standards and flexible for any new standard to be implemented in the future.

CHAPTER 4: MEDICAL QAWEB FEATURES AND BENEFITS

MEDICAL QAWEB is the softcopy QA and service solution based on the ASP business model for your Barco display systems. It is an online, secure web service for multi-facility, worldwide image quality management. It is easy to set up, flexible and offers service level options based on your needs.

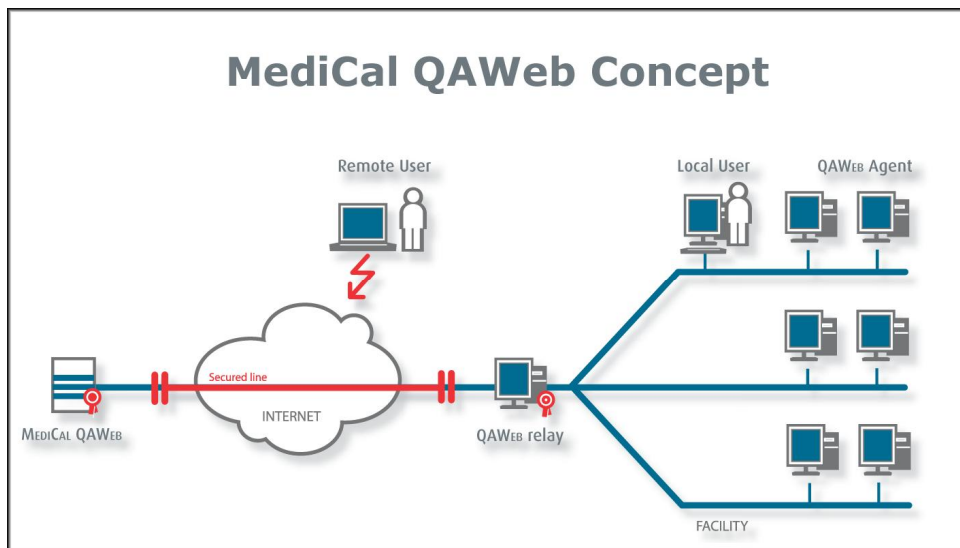


Fig. 4: MEDICAL QAWEB offers QA and service through a secured online service

A MEDICAL QAWEB Agent (as shown in Fig. 4) is installed on every workstation. It takes care of all local activity on the workstation and communicates with the different assets to control. The MEDICAL QAWEB Relay ensures a secure set-up and a single access point to the Internet. The central server runs in an ASP business model and manages the device information, the QA activity and reporting from one central point, accessible to every user wherever he is located.

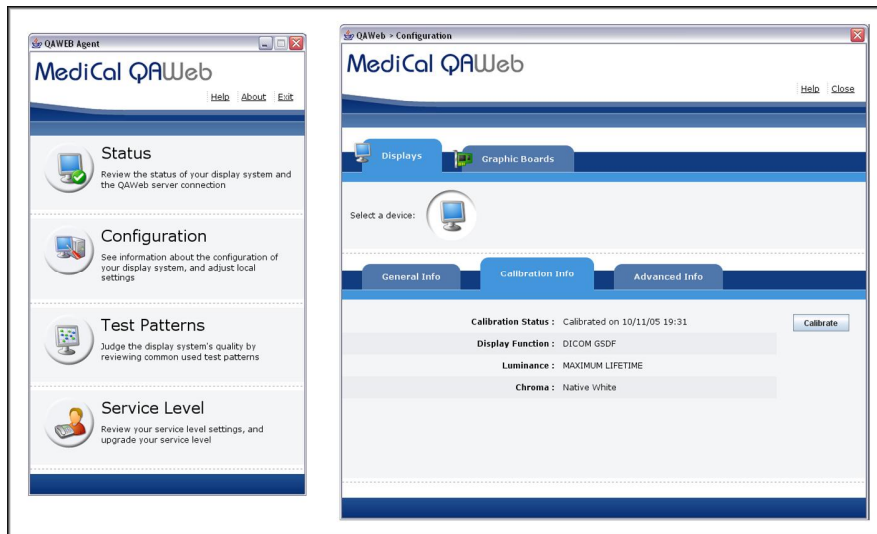


Fig. 5: MEDICAL QAWeb has a totally new user-friendly interface based on customer feedback

MEDICAL QAWeb is an innovative concept based on an advanced architecture with features and benefits for every stakeholder:

- Predictable service level options and costs: no surprises in the occurrence of a possible issue. A fast and efficient solution is on hand so workstation uptime is maximized.
- Single swap, color matched display options provide a very fast solution for the end user. The workstation downtime will be minimized and so will the hidden costs, such as logistics & installation/replacement.
- A stable and secure solution for device and asset management: continuous tracking of all critical workstations, displays and graphic controllers guarantee a full control of these important assets.
- No capital investments are necessary: service costs are budgeted annually and approved internally.
- Once the system is set-up there is less IT involvement and cost, since the data integrity is covered by the system.
- The flexible configuration management system of MEDICAL QAWeb allows you to control every Barco software component to be deployed as you wish (automatic, manual updates/upgrades).
- The setup cost of your medical workstations and displays will be much less since the installation will go faster with MEDICAL QAWeb: the level of transparency has been increased, remote installations are possible, etc. This will result in a big installation cost reduction.
- A powerful knowledge base system will investigate the root cause of a possible issue and suggest automated or manual solutions, all resulting in a more efficient and pro-active management of your installed display base.

- o An issue can be escalated to the service provider: thanks to MEDICAL QAWEB the diagnosis process will be optimal since all data is directly accessible for all parties, the end user, the service technician and, if necessary, a Barco support engineer. No need to explain that a faster solution will increase the workstation uptime drastically.
- o MEDICAL QAWEB applies asset management and calibration transparent to the end user: devices are detected and controlled without disturbing the workstation user (non-intrusive). Possible issues will be notified sooner and this again will minimize possible downtime.
- o Softcopy QA also runs in the background (even when no user is logged on), so more intervention free preventive maintenance is enabled. The diagnostic confidence increases without any manual effort or cost.
- o MEDICAL QAWEB distributes the right report to the right person: budget reports, activity reports and even JCAHO (Joint Commission on Accreditation for Healthcare Organizations) reports are available. These can be exported to PDF or Excel and enable you to further customize all information stored by MEDICAL QAWEB.

The advantages of working with MEDICAL QAWEB		
	Medical facility	Service Provider
Users	Radiology Manager, PACS Administrator, IT Staff, QA Technologist	Service Engineer, Support Manager, Sales Manager
Faster service take-off	An easy installation and a fast set-up time don't require a substantial amount of hospital resources	An easy remote installation and a fast set-up time accelerate the complete project acceptance by the facility
Cost savings	Remote and proactive interventions reduce unforeseen downtime and optimize workload	No need to have a service engineer on site all the time. Remote issue diagnosis and problem solving involves less traveling
Diagnostic confidence	Radiologists and QA technologists enjoy consistent grayscale and color quality at minimum effort	Bringing the end user confidence to the highest level
Easy budget planning	Easy budget forecasts with MEDICAL QAWEB customized budget reports	Asset management gives a clear view on the installed base and improves service and sales planning
Financial model benefits	No need to invest upfront	An all-in-one service solution based on a "pay per display, per year" model
An incident occurs...	There is always an up-to-date knowledgebase available, with easy escalation procedures	Easy and remote access leads to a faster issue identification and solution with an easy logistic process

CONCLUSIONS

Medical facilities seek optimum performance and diagnostic confidence through softcopy QA for their PACS workstations. A relatively quick return on investment requires a good service portfolio where predictable and clear service costs are available. The ASP business model, together with a secured online web service for central asset and quality assurance management, makes this possible. MEDICAL QAWEB running on innovative Barco display solutions will increase the workflow efficiency and assure radiologists peace of mind in their daily work.

REFERENCES

- [¹] Why is softcopy QA important -
http://www.barco.com/barcoview/downloads/Why_is_Softcopy_QA_important.pdf
- [²] Security and Privacy Requirements for Remote Servicing –
<http://medical.nema.org/privacy/remote.pdf>
- [³] How Barco addresses HIPAA -
http://www.barco.com/barcoview/downloads/How_Barco_addresses_HIPAA_US.pdf