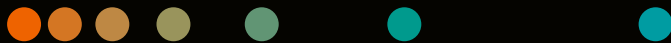


Syngo Carbon

The connecting element that
gives rise to knowledge

siemens-healthineers.com/syngo-carbon



The product(s)/feature(s) demonstrated/showcased here are not commercially available in all countries. Their future availability cannot be guaranteed.

Syngo Carbon: The Connecting Element that gives Rise to Knowledge

Building enterprise imaging for the future by connecting diverse departmental IT systems, multiple reading applications and data silos into one enterprise solution

Syngo Carbon

enabled by teamplay digital health platform

Access All Areas



Remote Scanning



Patient Access



Physician Access



Encounter-based Imaging



Open Image and Data Management

Just Use It



Actionable Reporting



Advanced Visualization



Dynamics Visualization



Artificial Intelligence



Archiving

Many Into One



One Workspace and One Image and Data Management



Workflow



Interoperability



Innovation and Research



Performance Management Applications

Services



IT Care Plan



Personal Education Plan



teamplay Fleet



Data Migration

Many Into One. Just Use It. Access All Areas.

Healthcare enterprises today face IT and data challenges all along the patient pathway, many of which cannot be simply addressed with a single product or a single software. Syngo Carbon is our solution that goes far beyond PACS. A game changer in reading and reporting, it provides healthcare enterprises all the imaging IT solutions and applications they need in one location. Syngo Carbon opens up possibilities in image interpretation, reporting, Artificial Intelligence (AI), and data management for the clinical environment. It grants access to extensive tooling and open data models across modalities in one integrated and user-friendly workspace, while at the same time customers benefit from simplified, purchasing, implementation and service.

Many Into One means that we do go away with varied imaging systems, user interfaces, vendor relations, service contracts, and complex legacy systems. ONE Syngo Carbon system manages it all. Our new reading and reporting workspace is combined with our open image and data management, all of which work across the entire enterprise. All imaging-related data is stored and processed in one central location that's always on and always available.

Creating insightful and reproducible diagnostic results faster and more efficiently is what clinical workers are expected to do, regardless of circumstances.

Just Use It is the philosophy we follow for enabling them to work quickly and with ease. Our new diagnostic workspace reduces complexity to a minimum. One application – with integrated innovative tools such as Actionable Reporting, Advanced Visualization, Artificial Intelligence, third-party tools and research prototypes – is all they need to learn.

Access All Areas is our solution for providing unlimited collaborative capacity. Syngo Carbon provides physicians, technicians and patients access to all relevant medical information. Our remote scanning solution allows hospitals to seamlessly share the skills and talents of their most skilled technologists across the entire fleet. Physician Access and Patient Access enable the sharing of patient data both within and outside of the hospital environment, ensuring better collaboration and higher patient satisfaction.

Syngo Carbon has been designed to help reduce your IT costs by supporting IT consolidation and integration, both within a department and across the enterprise. The open design allows for easy integration of existing modalities and other IT assets, including legacy PACS systems. Interoperability across multiple systems based on common standards is a given.

Syngo Carbon – our comprehensive imaging IT portfolio – **is the connecting element that gives rise to knowledge.**

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Many Into One

The core of Syngo Carbon combines 2D/3D routine reading with a powerful Image and Data Management to reduce complexity and simplify the clinical IT landscape.



Innovative and intuitive UI elements – SmartSelect and Findings Navigator – enable quick reading



Patient Jacket, the all-in-one information center for a comprehensive access to patient data and studies



Patient and study browser for fast and easy navigation and identification of studies and series including Token View



Easy access to innovation and research applications as well as to actionable results

3D

2D/3D capabilities for routine reading and basic Advanced Visualization

Syngo Carbon Core

The Syngo Carbon Core gives rise to knowledge by providing a highly efficient, high-quality and optimized clinical environment. It grants access to a wide range of possibilities in 2D/3D reading, visualization, reporting, AI implementation and enterprise data management.

Designed for frequent heavy use, the Syngo Carbon Core unites intuitive reading and

reporting with a robust and highly scalable image and data management system. Its unique and intelligent 2D/3D multi-modality reading is easy to learn, with minimal complexity. You will have unique access to an integrated innovation platform featuring the latest in research and third-party functionality.



One Workspace

With Syngo Carbon, clinicians can access all relevant data and tools in one spot, through one brandnew unified interface.

The Siemens Healthineers User Interface (SHUI) comes with a guided structure for intuitive reading, with color-coded timepoints and intelligent layouts. It dedicates more space to the clinical image, allowing healthcare providers to focus more on the patients.

Extending beyond simple reading and reporting, Syngo Carbon empowers users to easily integrate modular solutions such as Advanced Visualization and Cardiovascular Imaging and Reporting. Packed with the latest innovations and AI-enabled features, Syngo Carbon combines the best of imaging, design and data management into a single enterprise imaging solution.



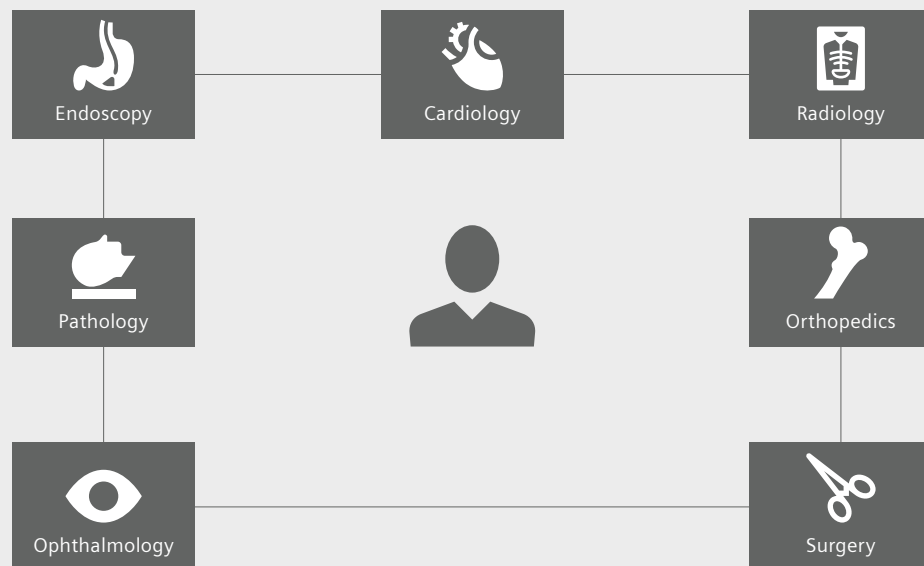
Image and Data Management

A robust Image and Data Management (IDM)¹ system sits at the core of Syngo Carbon. All patient-centric data points are consolidated into one spot. Always on and always available, the Syngo Carbon Core is where data turn into strategic assets.

With Syngo Carbon, you can acquire and store different image and photo formats, DICOM CDs (DICOMDIRs) as well as digitalized video sources – such as those from endoscopy or microscopy – in the right context.

All documents and file forms are digitized in their raw formats, so that the native, actionable data can be distributed throughout the enterprise.

Syngo Carbon's modularity, centralization, and scalability empowers healthcare providers to flexibly manage data to match evolving organizational needs and reduce long-term cost across the entire healthcare network. It is designed for growth – from multi-departmental, to enterprise-wide, to regional set-ups. To control expenditures, Syngo Carbon offers various image lifecycle management strategies with storage devices on premise, on the cloud, or both.



Patient-centric data management

- Aggregation and visualization of all relevant patient data across workflows and clinical departments

Centralized data management

- Single point of integration brings silos together
- Multi PACS and Multi VNA accessible

Future-proof data management

- Fully compliant to current standards (DICOM; HL7; FHIR, IHE)
- Data strategy transformation from medical department to integrated patient care enterprise
- Highly scalable, across the entire enterprise

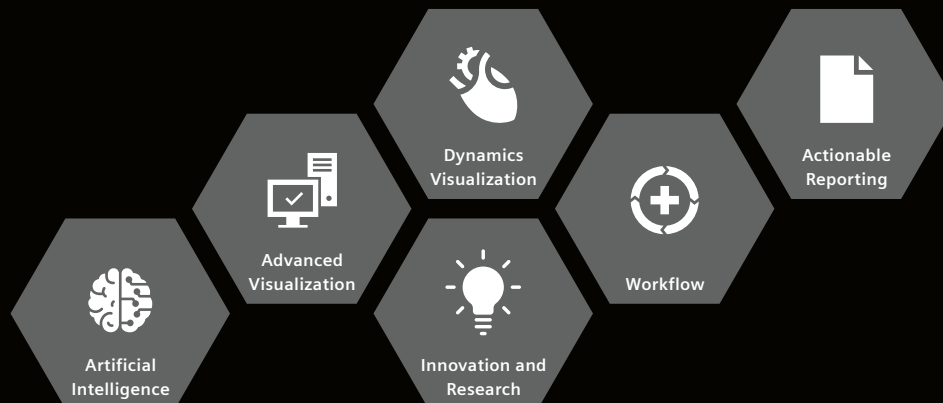
The solutions serve to centralize interfaces, storage requirements, and data management functions. Syngo Carbon manages medical data uniformly, independent of format or source. As a data hub in the healthcare enterprise, the IDM can simply connect to existing information systems and subsystems (including HIS and RIS), in full compliance with current standards.

Equipped with a zero-footprint enterprise viewer, Syngo Carbon is the ideal component for the enterprise-wide distribution of various types of DICOM image data (including DICOM CT, CR, MR, US, XA, and WSI), DICOM ECG and SR as well as multimedia data (non-DICOM data such as PDF, CDA, JPEG/PNG, and common video formats such as MPEG, H.264) from a VNA and all other connected DICOM archives.



Just Use It

Tackle the steadily increasing data volume with our brand-new workspace. One workflow and intelligent assistants make reading and actionable reporting simple and effortless – boosting your productivity.





Actionable Reporting

For over 100 years, radiologists have produced prose reports that vary wildly in style, format, and length. Standardized reporting, which would have made extracting the information needed to provide comprehensive patient care easier, was rare.

Utilizing the unified language and streamlined structure, radiologists could more accurately describe radiological findings. Though an important step towards standardizing reporting, it was but one of many still needed to take radiological reporting to the next level.

Syngo Carbon empowers healthcare providers to step into the new era of reporting – Actionable Reporting. In Syngo Carbon, all findings are translated into coded data that can be read and edited by other systems,

independent of format. This reduces reporting errors and helps make results more reproducible.

To ensure a superb reading and reporting environment, Siemens Healthineers partners up with industry and innovation leaders Nuance PowerScribe One and Smart Reporting. All relevant data – including patient information and images, as well as prior and current procedures and reports – can be accessed in your reporting cockpit. Created with an interface that is tightly intertwined with Smart Reporting, your reports have a harmonized look and feel.

With these powerful Syngo Carbon tools, you can turn your imaging insights into actionable results.



Advanced Visualization

Growing clinical demands and requests have become routine for radiologists. To help you work faster with more convenience, Syngo Carbon's Advanced Visualization² offers AI-powered applications and fast multi-modality and multi-disciplinary 3D and 4D reading. The integrated imaging software unifies and centralizes intelligent tools in one powerful diagnostic workflow. The solutions are adaptable to your needs and include the broadest range of clinical and modality applications.

Syngo Carbon's Advanced Visualization:

- standardizes reading
- simplifies your diagnostic process with a comprehensive multi-modality solution that serves all clinical fields,
- uses AI to support you throughout a broad variety of clinical applications,
- integrates advanced tools and innovative applications, as well as the latest technologies and algorithms, for routine to advanced reading,
- integrates established solutions with real-time findings to streamline and optimize your reports, and
- delivers actionable image-based results that assist in you in generating structured and consistent reports to navigate care delivery.

This is how we advance the digitalization of healthcare.



Dynamics Visualization

Dynamics Visualization³ – our cardiovascular imaging and information solution – is likewise designed to enable enterprise-wide reading and smart structured reporting.

Its customizable and fully automated clinical workflows provide a single point of access to a cross-enterprise cardiology platform. Dynamics Visualization ensures connectivity as the key pathway for improving care delivery today, to support in building a discrete and structured database for the scientific research of tomorrow.

Using Dynamics Visualization's intuitive software, clinicians can create custom worksheet and report templates that meet the needs of

cardiovascular and ultrasound procedures and workflows.

Customers can build worksheets and reports by importing data from a qualified modality or selecting automatic and/or manual observations. The reports are auto-populated from measurements and calculations based on customizable ranges established from clinical standards and guidelines.

Dynamics Visualization also provides quick and easy access prior reports and do historical comparisons. Numerical data and diagnostic observations that are displayed in worksheets are stored in a database for data mining and retrieval.



There is AI in Certainty

Artificial Intelligence (AI) is built into many of Siemens Healthineers' innovations. Our AI-powered systems and solutions empower you to automate, standardize, and individualize care delivery and management. The outcome: intelligent data for enhanced efficiency and productivity, higher quality of care, and a better patient experience.

Siemens Healthineers' AI functionalities aid you in creating valuable clinical images and quantitative clinical information to support diagnostic work. Our growing family of extensions with state-of-the-art algorithms – which includes AI-Rad Companion⁴, ALPHA technology, and Similar Patient Search, among others – integrate seamlessly into your daily workflow. The algorithms are cloud-based so that they can be easily implemented within your IT landscape.

By utilizing our AI-based, advanced image processing algorithms, you will see:

- accelerated, more efficient workflows,
- increased precision and accuracy for better clinical outcomes, and
- standardized results reduced inter-reader variability as well as improved reader confidence.

The AI algorithms address the most prevalent use cases in the clinical workflow:

- Automatic case analysis including findings that are relevant to performing an AI-powered triage
- Prioritizing the reading worklist to alert the clinician
- Automatic post-processing and machine interpretation of results prior to physician reading
- Automatic detection, measurements, and diagnosis preparation as structured content, which is then integrated into diagnostic reports

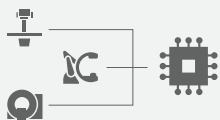
How does artificial intelligence support reading and reporting?

Syngo Carbon's intelligent algorithms include anatomical registration, automatic spine/rib labelling, AutoViews, organ-based segmentation, automated measurements and real-time correlation to reference datasets, as well as speech recognition and voice commands. They help speed up and boost the quality of routine reading.

The Similar Patient Search (SPS) will support you to improve diagnostic confidence and speed up the diagnostic process. Poring through medical literature or manually

searching for similar cases in the system is time-consuming. SPS automates the later. Comparing your case and the reference image against others is done quickly, giving you more time to dedicate to the patient.

AI-Rad Companion is Siemens Healthineers' product family of state-of-the-art clinical applications that supports radiologists with their clinical decision. Artificial intelligence supports the decision-making process by (semi-)automating the analysis of clinical imaging data, as well as the presentation of results and report generation.



1. Multi-Modal Input

Input DICOM studies produced by different modalities for certain examinations is automatically sent to an integrated AI assistant.



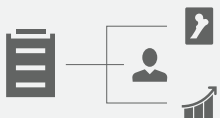
2. Intelligent Dispatching

The algorithms to be executed are automatically selected depending on the data content.



3. Automated Results Generation

Input DICOM studies produced by different modalities for certain examinations is automatically sent to an integrated AI assistant.



4. Multi-Channel Output

Web-based infrastructure and plug-ins in partner systems enable user feedback and continuous improvements of algorithm functionality.



5. Supported Workflow

Results are dispatched to the appropriate target systems (e.g. PACS).



1,100,000,000

More than **1.1 billion** clinical images as well as reports, clinical and genomic data



Worldwide super-computing infrastructure with **600 AI experiments** per day



More than **600 patent families** related to machine learning and **more than 200 patent families** related to deep learning



Innovation and Research

Syngo Carbon enables easy access to innovative partner solutions, ground-breaking research prototypes, as well as new software from Siemens Healthineers via the fully-integrated Digital Marketplace^{5,6,7}.

The Digital Marketplace is continuously enriched and expanded with innovation applications. Customers can try any of the OpenApps^{8,9} (e.g. Circle42, Materialise, or PIE) for free for 90-days, during which time you can purchase the software directly through the third-party vendor.

Easily access the Digital Marketplace with one click on the shopping card icon in the right upper corner in the one workspace. You can register for free to access latest 3rd party application, innovation and research solutions via the Digital Marketplace. To integrate the research prototypes in the Syngo Carbon workspace, a Syngo Carbon Frontier^{10,11} license would be needed. Frontier users can not only access all available prototypes, but turn ideas

into tangible software, which can be shared with a wider community on the Digital Marketplace.

The tight integration of Syngo Carbon and the Digital Marketplace shortens the clinical workflow and results in lower hardware costs. Customers can simply utilize all innovation and research applications running on the Syngo Carbon hardware without purchasing or maintaining additional hardware.

An example of Frontier innovation and research success is the Pulmonary Density Plug-In¹². The application helps to segment and quantify ground-glass opacities and high densities in the lung. Clinicians can get a quick and easy overview of the lung with a complementary color-coded pictogram and key. In addition, Volume Rendering Technology (VRT) provides an overview of the opacity spatial distribution. Accessed via the "Favorites Toolbar" the algorithm can be activated with just one click.



Digital Marketplace

Explore apps for cutting-edge care from Siemens Healthineers and solution partners



Cloud-Based
Partner Apps



On-Premise
Partner Apps



Research Apps
(not for clinical use)



Siemens Healthineers
Apps



Workflow

Syngo Carbon Core is designed to improve image reading and reporting workflow. It enables intelligent worklisting for clinical demonstration and reporting.

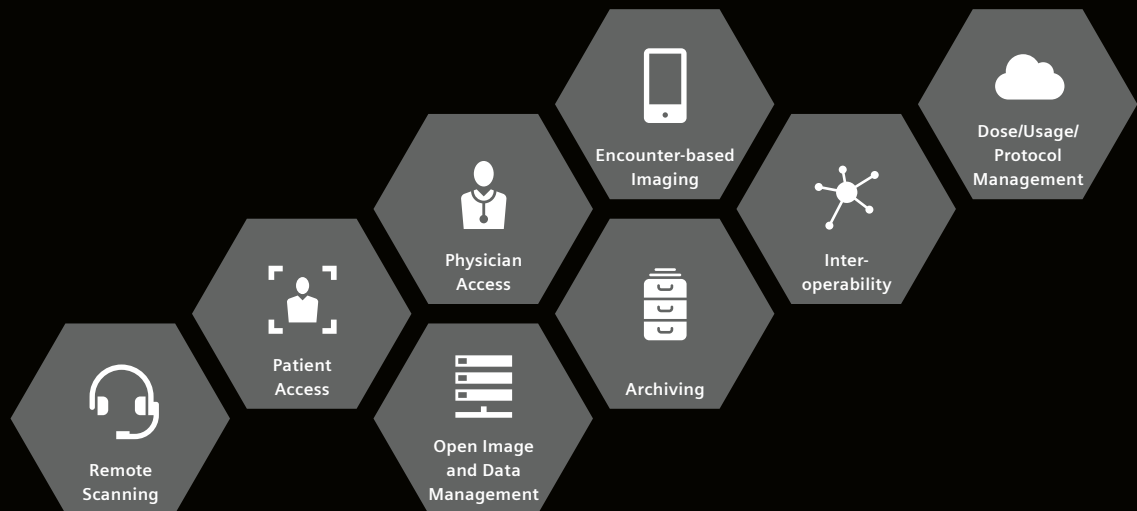
Syngo Carbon smoothly integrates clinical workflow solutions, such as Radiology Information Systems, Enterprise Imaging Workflows and Electronic Health Record.

Dedicated workflow solutions are syngo Workflow SLR¹³, Medicalis Workflow Orchestrator¹³, and others from our global and local RIS partners. Customers can access relevant diagnostic information across the entire enterprise in one workspace.



Access All Areas

Overcome fragmented data silos and consolidate patient data points. Make patient data and expert knowledge easily accessible across the healthcare enterprise and bolster collaborative powers.





Remote Scanning

Syngo Carbon Remote Scanning^{14,15,16} transforms care delivery by allowing to seamlessly share the skills and talents of the most skilled technologists across the entire fleet.

Remote Scanning relieves cost pressure by enhancing flexibility. By offering advanced procedures in any location, customers can increase productivity, achieve greater diagnostic consistency and generate additional revenue.

Remote Scanning capability enables to rethink teamwork, increase workforce productivity, bridge bottlenecks, and ensure high-quality care. All the while, staff members will feel more competent and confident. Remote-scanning assistance help technologists work like experts and enhance patient satisfaction. With experts being accessible virtually, healthcare providers can offer the highest quality care in all locations.

Remote Scanning can support a mix of complex and simple procedures by connecting three

scanners simultaneously. Technicians can support or scan multiple exams simultaneously to optimize your schedule.

Syngo Carbon Remote Scanning streamlines secure communication over multiple channels. Multiple communication modes such as text and voice chat (VoIP), video and screen sharing ensures that technologists and experts can correspond in the fashion most suitable to their work environments. This will lead to increased productivity and comfort levels.

Remote Scanning helps to reduce travel for patients, technologists and radiologists. This might result in lower transportation costs for patients travelling to sites where the examination is offered. The staff can support special examinations without needing to be onsite. Remote Scanning enables technologists to access the scanner (CT, MR, PET/CT, SPECT) remotely from all areas, even from home – removing them from risk.





Patient Access

The Syngo Carbon Patient Access¹⁷ is designed to improve cooperative care and involve patients in the clinical pathway so that healthcare providers can deliver high-quality care. With it, patients can view all of their personal imaging reports, data and examinations – which are stored in the Syngo Carbon Archive – by logging-in to its user-friendly HTML5 web-based interface.

Making patient data readily available not only empowers patients, healthcare workers also benefit from more efficient collaboration and better patient management. Through Syngo Carbon Patient Access, patient images can be shared electronically, bypassing analog means such as CDs, for example. This reduces processing errors, saves time and cost and improves the patient experience.



Physician Access

Syngo Carbon Physician Access¹⁸ is an enterprise-wide internal web tool for viewing DICOM, non-DICOM, multimedia data and clinical documents.

Through its intuitive web-based viewer, clinical users can quickly and simultaneously search and access relevant DICOM and non-DICOM images, multimedia data and clinical documents from all connected departments and systems – such as the Syngo Carbon Archive, PACS, DICOM, SCPs.

A zero-footprint enterprise viewer, Physician Access is ideal for enterprise-wide distribution and cross-departmental collaboration. It comes with annotation tools such as freehand drawing and text writing that serve to enhance collaboration in meetings.

With the tool, you can quickly search, display and process patient medical information, which includes prior patient history, previous examinations and data from external archives.

Search results are displayed within a table with freely configurable columns.

This is especially useful for cross-departmental boards, such as those that utilize both radiology and pathology images.

Persisted queries can be auto executed as a default at login and be automatically refreshed at set intervals, to make it easier for practitioners.

Physician Access' integrated patient jacket gives a comprehensive overview of all data for selected patients and fast access to prior exams and patient history.

Precision and performance

Security and performance are highly important in the clinical environment, and the HTML5 based Physician Access is designed for speed. Prefetching and caching ensures that user experience is constantly improved and updated. Exclusive server-side image rendering guarantees that clinical annotations, like distance and density, can be displayed with maximum precision on any computer or workstation, independent of browser.



Encounter-based Imaging

With Syngo Carbon's Encounter-based Imaging^{19,20}, acquiring and transmitting clinical data – such as documents, pictures, audio and video files – from point of care to the central image and data management infrastructure becomes easier than ever.

The system is compatible with mobile devices and smartphone. Encounter-based Imaging makes it easy for medical workers to capture images from both within and outside of the healthcare enterprise, fostering mobility. This eases daily routines such as ward rounds, wound documentation, as well as emergency photo and video acquisition. The app also supports remote medical support processes where multimedia acquisition is done in medical care centers or nursing homes.

Added value

- Facilitates the point of care workflow
- Precise ad hoc documentation
- Fast distribution of information
- Use of existing technology





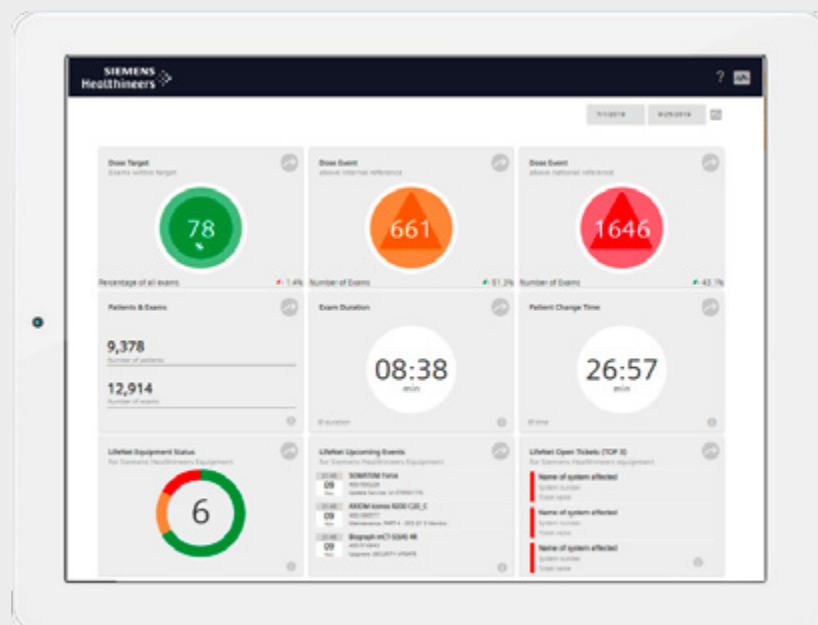
Performance Management Applications

The integrated teamplay²¹ applications are dedicated to healthcare performance management. They give administrators instant, centralized access to operational, technical and clinical data to help them optimize their operations and deliver optimal healthcare.

The apps analyze and quantify imaging throughput, dose levels, and staff utilization²²; they also monitor equipment status, service tickets and departmental resources down to each device and each procedure. Having a clear overview of clinical and operational performance data makes it easier for staff to make well-informed decisions quickly. It also helps them to identify and implement measures that help standardize clinical operations and simplify reporting.

The teamplay performance management applications run on the teamplay digital health platform. Smart connections between the apps amplify data insights and provide a seamless user experience. The software also offers connectivity to other teamplay users and their data, enabling comparative benchmarking²³ and simplifying the exchange images and reports. Managing equipment holistically and efficiently, 24/7 and from any PC or mobile device²⁴ is also easy.

teamplay gives easy access to solutions for operational, clinical and shared decision support – combining flexibility and scalability with future readiness. By connecting to one vendor-neutral, system-neutral and device-neutral platform, clinical providers worldwide can benefit from innovative solutions along the entire patient pathway and turn data into cost savings and better health patient care.





Open Data Management & Archiving

With Syngo Carbon's open Image and Data Management²⁵, healthcare enterprises are well-equipped to cope with developments in data management, so that they can grow with new challenges, instead of being slowed down by them.

Syngo Carbon's solid, sustainable and scalable platforms combine isolated departmental data and support standards that enable interoperability. This establishes the foundation for integrated data lifecycle management. A holistically structured information and knowledge base enables machine learning and automated AI-driven informed decision making.

In the IDM, interfaces, storage requirements, and data management functions are all centralized. Medical data is managed uniformly and independently of format or source. As the data hub in the healthcare organization, the IDM enables simple, standards-compliant connectivity into existing information systems and subsystems (including HIS and RIS).

Syngo Carbon's IDM connects healthcare professionals across enterprises, enabling better and more efficient collaboration. The sharing of data helps eliminate unnecessary cost and improves patient safety and outcomes.

Syngo Carbon's Enterprise IDM infrastructure is IHE compliant. Clinicians can exchange patient data regionally or nationally without having to leave the system that they are familiar with. Furthermore, XDS/XDS-I Source or -Consumer provides integrated support for releasing documents, publishing data in a patient portal, or cooperating between departments.

Built to ensure secure access and transactions, high performance, data scalability and reliability, Syngo Carbon Archiving²⁶ meets all essential criteria for long-term VNA data storage in a healthcare enterprise.

With Syngo Carbon Archiving, users can manage patient-centric images, video documentations and documents, and access multiple PACS systems with ease. The system makes it easy to acquire data with different formats from different sources and share them across healthcare facility boundaries.

The solution includes a long-term data archive (LTA), in which diagnostic findings and documents from an EMR and other departmental-specific systems are archived in one consolidated data structure. The archive can be accessed via a user-friendly viewing interface, which will universally display numerous DICOM and non-DICOM file formats.

With Syngo Carbon Archiving, conducting a comprehensive search through all connected archives is simple. Our user-friendly configuration makes it easy for physicians to filter results. The solution includes:

- Support of the latest private DICOM SOP classes
- Simple configuration of relevant ILM strategies high-throughput DICOM migration
- System monitoring and statistics through standardized queries
- Inbound and outbound communication via interfaces and event handlers
- Prefetching and auto-routing via HL7 or DICOM Modality Work List (DMWL)
- MPI supportability
- Multi-client architecture for separate institutions
- Provision of data stored in the archive as IHE-compliant XDS Repository



Data Interoperability

Syngo Carbon is designed to eliminate isolated data silos to improve information flow and speed up clinical workflow.

Syngo Carbon's standard compliant connectivity allows hospitals to get the most out of their existing IT infrastructure. Its highly customizable key solution and open integration enable an improved patient-centric workflow across departments and beyond. Patients get access to the right clinician at the right time. Clinicians get access to the right patient data. Remote assistance, telehealth and home monitoring support caregivers and improve patient outcomes.

Loosely coupled consolidation is enabled by our third-party VNA functionality, query spanning and remote node integration via high performance DICOM communication. Various send and export functions enable the quick passing of medical records on to other systems and storage solutions.

With Syngo Carbon's new dossier feature, users with the right permissions can export structured large datasets, including metadata, from one or more patients. The result is a self-contained dossier that is stored as encrypted ZIP-file on a fileserver.

With Syngo Carbon's Image and Data Management, managing clinical documents across the enterprise is simple. Its deep integration enables the IDM to provide comprehensive, IHE- compliant, institution-wide provision of data.

IHE compliant (integration based on standards)

Standard interfaces – such as DICOM for imaging data and HL7 for medical document transmission – apply to most integration scenarios. Images and documents generated in departmental systems can be easily and automatically added to the electronic medical records, which are maintained in Syngo Carbon Archive via HL7 MDM message, with BASE64-encoded payload. Imaging systems and PACS are similarly connected via DICOM for automatic archiving.

Moving current and historical reports and exams, and their respective images, back and forth between PACS and the archive via DICOM Q/R is easy, with Syngo Carbon. The solution leverages comprehensive HL7 ADT and ORM/ OMI support to synchronize departmental information systems with the central IDM infrastructure. This applies to both DICOM and multimedia documentation.

Reversely, MPPS and IAN (HL7 ORU) provide a notification mechanism for alignment with RIS and PACS. Furthermore, for linking document metadata and access references into an EMR/ HIS Syngo Carbon provides a reference pointer mechanism based on HL7 ORU. Various further event handlers offer simple and extremely diverse options for asynchronous outbound interfaces such as document routing, HL7 events routing, ATNA auditing or email notifications. The system guarantees seamless integration and synchronization with departmental systems, information systems and local PACS.

Third-party VNA

Syngo Carbon provides archiving and synchronization mechanisms that manage nearline DICOM data to connect to and synchronize with other DICOM archive providers and VNAs.

By means of DICOM Storage Commitment, Syngo Carbon ensures that DICOM data is successfully taken nearline. IOCM-mechanisms synchronize local image data with the third-party VNA.

Image file deletion and the retrieval and reintegration of nearline data are governed by configurable prefetching rules based on patient-admission (HL7 ADT), order (HL7 ORM) or DICOM import triggers.

Special use case: backup archive for HIS

A closely integrated link between an EMR/HIS and Syngo Carbon Archive makes it possible to (automatically) open archived documents from the Syngo Carbon Core into a patient record.

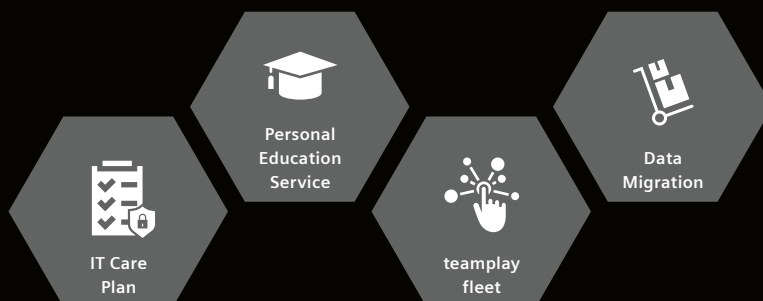
Here too, synchronization is done through HL7 messages and DICOM MWL. This ensures that documents in the archive will become part of the operational patient record.

Thanks to such deep alignment, the EMR/HIS and Syngo Carbon manage a synchronized data view; all documentation are managed in the image and data management layer. In the event of an EMR/HIS outage due to failure or maintenance, Syngo Carbon can supply adequate backup access to patient files via its universal viewing client.



Services

Alongside our Syngo Carbon solutions, we also offer high-quality service solutions tailored to your needs.



Enjoy a worry-free solution with a strong strategic partner from the start

How can hospitals get the most from ever-tighter budgets? The Syngo Carbon solution from Siemens Healthineers generates a high return on investment throughout its lifecycle. Expert consulting and professional implementation ensure a perfect match with healthcare needs and fast availability. The agile solution adapts to changing conditions and prevents their technology from obsolescence.

Meet your timeline

Meeting quality, time, and budget needs is a must. Our highly experienced clinical consultants and professional project managers, all of whom are vendor-independent certified Project Management Professional (PMP)s, will work closely with you to make this happen. As a team, they will ensure reliable and fast implementation.

Specific needs

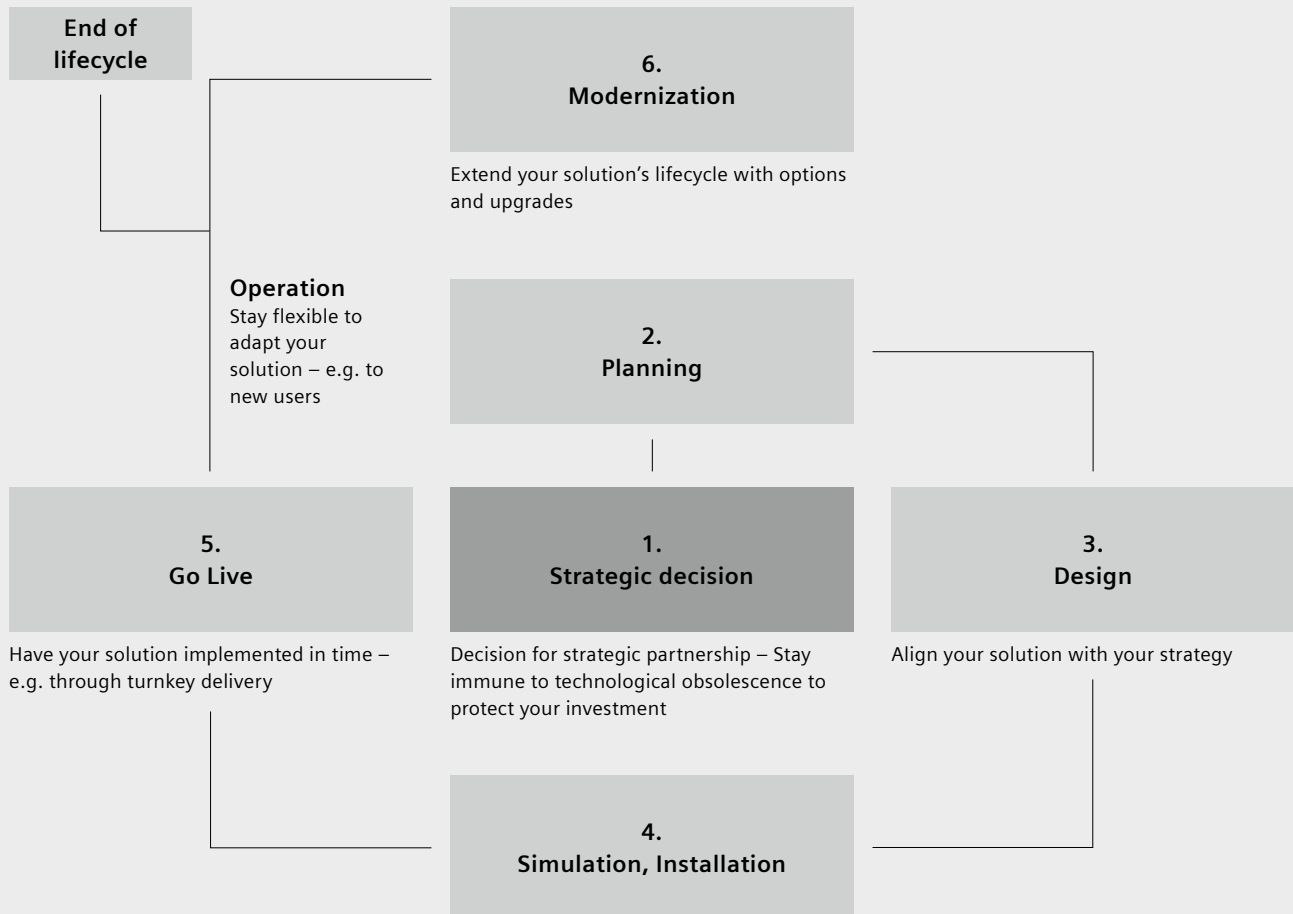
Always get a high-quality solution. The Syngo Carbon solution is designed for easy deployment in virtually any existing IT infrastructure. In some cases, however, custom-made integration or software modules help optimize workflows. Experienced senior solution engineers professionally test, and implement additional pieces of software that may be needed.

Minimize your risk

Organizational needs, budget, and strategy are unique. So are the business models that Syngo Carbon offers. Whether through a one-time investment or recurring payments, Siemens Healthineers can help medical institutions expand smoothly. Consulting experts can analyze and assess their situation and understand their future goals to create a perfect solution.

Protect your investment

Fully integrated IT Services help keep enterprise imaging IT systems up-to-date and highly available. With continuous updates and upgrades, we protect imaging and related software from becoming obsolete.





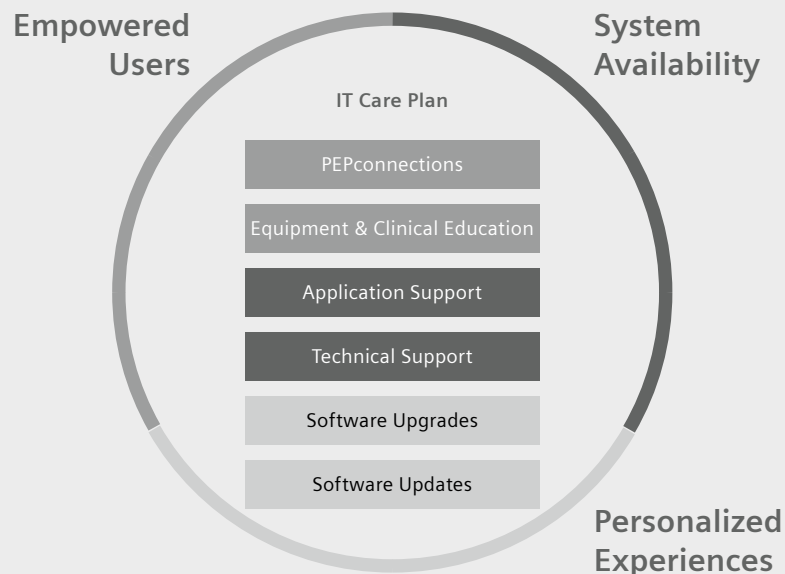
IT Care Plan

Acquiring best-in-class medical equipment is just the first step for staying competitive in today's constantly changing healthcare environment. Managing IT solutions and their associated resources well is also vital for saving time and reducing costs.

With the IT Care Plan from Siemens Healthineers, healthcare enterprises can protect IT investment and increase system availability. By proactively monitoring their systems and getting access to continuous remote support, clinical facilities can minimize downtime over the entire serviceable lifetime. Regular remote software updates and upgrades also keep clinical IT solutions reliable and secure.

The IT Care Plan comes with a personalized education and performance experience – designed specifically for healthcare professionals – to help boost staff competency, efficiency and productivity.

With a reliable partner to help improve the efficiency and productivity of their healthcare IT solutions throughout their entire serviceable lifetime, hospitals can ensure increased return on investment.





Personalized Education Plan

To ensure that healthcare personnel are equipped with the right expertise, and to improve their productivity, Siemens Healthineers offers continuing education tailored to their needs.

Clinical staff will receive an initial training designed to ensure a seamless onboarding and make it easy for them to adapt to the new clinical workflow.

The holistic training, which covers the overall imaging IT solution, will be delivered by the Clinical Education Specialist. It includes:

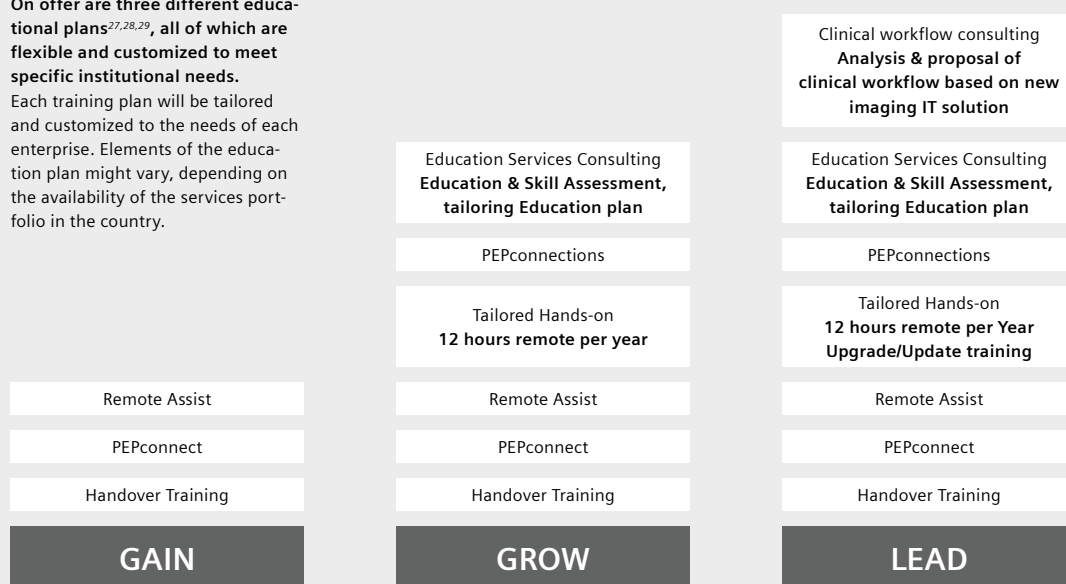
- Pre-training clarification
- Pre-training online learning activities to ensure a more efficient hand-over training
- Dedicated training of the imaging IT solution customized to each healthcare facility's clinical workflow. All trainings are tailored to the specific applications in the solution and to the individual needs of the users in the facilities.

Healthcare employees will get access to PEPconnect – the Siemens Healthineers learning platform – so that they can brush up their knowledge at their own pace, anytime, anywhere. Online trainings and educational videos are likewise available. PEPconnect also offers Job Aids documents that focus on the utilization of your imaging IT solution.

With PEPconnections – our premium subscription for workforce education management – enterprises can assign and manage employee education to ensure that their staff are on continuous education paths. Companies will also have access to Education Services, which is only available in PEPConnections.

On offer are three different educational plans^{27,28,29}, all of which are flexible and customized to meet specific institutional needs.

Each training plan will be tailored and customized to the needs of each enterprise. Elements of the education plan might vary, depending on the availability of the services portfolio in the country.





teamplay Fleet

Syngo Carbon enables easy access to **teamplay Fleet**^{27,30}, the customer service online portal that allows facilities to manage the performance of their equipment from Siemens Healthineers 24/7, from any device. An array of features provides extensive transparency, enabling them to maintain visibility and control at all times – so they can easily tackle the challenges presented by an increasingly digital industry. **teamplay Fleet** allows healthcare providers to:

- Monitor their fleet effectively and save time by seeing the status of their equipment and service tickets at a glance
- Plan ahead and maximize productivity by confidentially handling upcoming upgrades, maintenance, training, and cybersecurity needs
- Manage equipment effectively by analyzing service metrics with on demand access to in-depth equipment and service event reports





Data Migration

The DICOM interface is optimally parallelized to facilitate the physical migration of DICOM data from legacy archives to a long-term archive, such as the Syngo Carbon Archive. Migrating 5 terabytes of image data per day and handling up to 3.5 million procedures a month are benchmarks that the system has easily passed.

To further improve migration throughput and optimize data consolidation, Syngo Carbon Image and Data Management supports DICOM header-only migration as a means for lazy migration. The DICOM interface can be configured to accept the submission of header data only. The payload of the DICOM object is automatically set to nearline, while all relevant metadata is maintained in the local database, as of a third-party VNA. Upon image access, the nearline documents are imported and eventually migrated to the Syngo Carbon Archive.

The Smart Data Conversion (SDC) tool is a highly integrated data conversion software, comprising direct control of DICOM, non-DICOM and HL7 components, direct disk based LTS access,

monitoring for all kind of legacy Siemens Healthineers and third-party PACS and VNA systems and new Siemens Healthineers systems, database access to Siemens Healthineers system for verification purposes.

With its parallel processes and tight integration, SDC enables high-speed conversion, bringing optimized throughput and minimal disruption to daily work.

With the SDC conversion the new Syngo Carbon workspace provides access to all images:

- Prior studies are available as quick as possible (through prefetching, prioritization of studies)
- Data stays consistent (Data Correction, Conciliation)
- Minimized impact to daily work (with monitoring of Source and Target system)
- Conversion can run in background (through Automated Error Handling)
- Conversion is finished as soon as possible (high performance, scalability)

The SDC package includes:

- Setup and configuration
- SDC monitoring and ramp-up
- Data conversion
- Conversion verification, and
- Post-conversion tasks (such as error analysis and handling, final report).

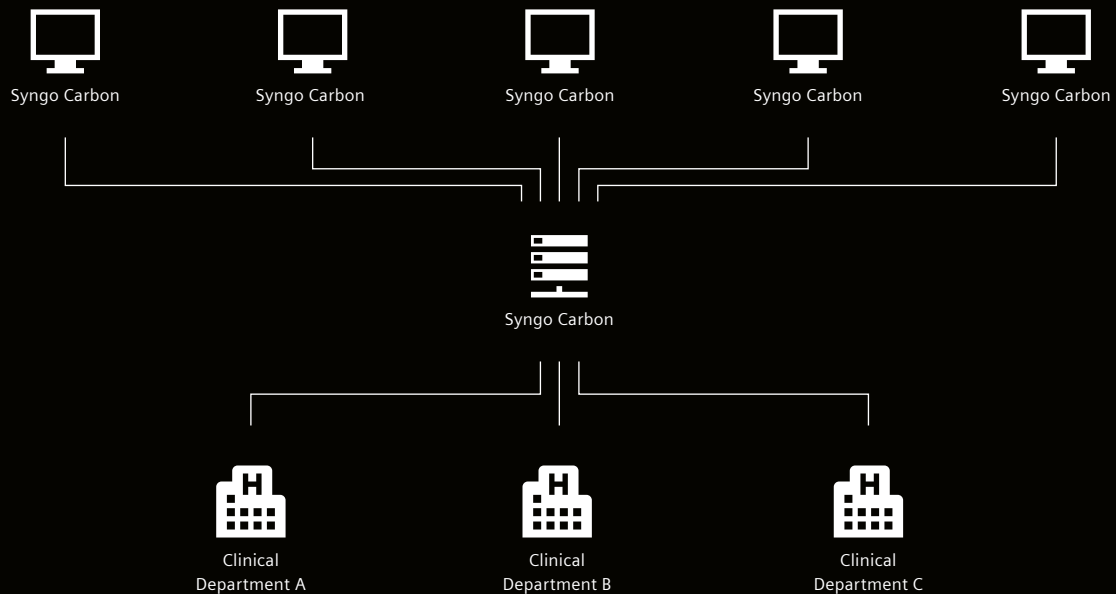
Benefits of an SDC conversion:

- The ability use the system while conversion is running in the backgroundAccessing legacy images anytime (query spanning)
 - Fast loading of converted legacy images
 - Prefetching of images and image data cleanup
 - Reduced system complexity and regular reporting
-



IT Solution Assets

With Syngo Carbon, companies are opening the doors to a completely secure, flexible, highly scalable, and fully integrated solution that grows with their needs.



Scalability

Besides fast online access and high data security, some of the most important benefits of an enterprise-wide imaging IT solution are flexibility and high scalability.

From the smallest installations with a few scanners and a couple of terabytes of data, to large regional solutions with hundreds of data sources and petabytes of storage, Syngo Carbon can power it all. The cutting-edge Syngo Carbon IDM architecture makes it possible to provide enterprise-wide image and data acquisition, viewing, management, sharing, and archiving with the same software for any number of end users.

With Syngo Carbon, companies can flexibly scale hardware power – modifying the number of servers and the number and size of storage media – during operation or with minimal maintenance interruption. The system is designed to run in fully virtualized infrastructure, whether on site or in the cloud, and is optimized for future growth and data consolidation. The software can grow with the need of the healthcare enterprise and supports large-volume migrations with ease.

Tenancy

Syngo Carbon enables multi-tenancy, in which multiple independent tenants can be operated within one installation. In multi-tenancy, each tenant is its own completely logically encapsulated VNA, despite sharing hardware and software with other tenants.

Communication and integration across tenants are possible only via external interfaces. Cross-references between different tenants don't occur; each tenant only sees and access its own data and processes.

Multi-tenancy with a clear separation of concerns (patient context, workflows, data integration) is a pre-requisite for software-as-a-service offerings or on-premise installations. Not multiplying software and hardware needs generates cost savings and efficiencies.

Security

Siemens Healthineers is committed to working with healthcare providers to fulfill their cybersecurity and privacy requirements. Our Product and Solution Security Office is responsible for the global program that focuses on addressing cybersecurity throughout the product lifecycle of our medical devices.

The program aims at incorporating state-of-the-art cybersecurity in current and future products. We seek to protect the security of patient and provider data while at the same time providing measures that strengthen the resiliency of our products from external cyber attackers.

We comply with applicable security and privacy regulations from the US Department of Health and Human Services (HHS), including the Food and Drug Administration (FDA) and Office for Civil Rights (OCR), to help meet clinical IT security and privacy obligations.

Patient and clinical data are defined as highly sensitive by European and international legislation.

We ensure continuous product and solution security as well as patient safety throughout the entire software and deployment life cycle.

The solution uses symmetric as well as asymmetric cryptography to prevent clinical data from being exposed to unauthorized persons.

User Roles

The system distinguishes between clinical and administrative roles. Because clinical users don't need administrator privileges, authorization is required for administrative tasks.

The Syngo Carbon supports:

- Lightweight Directory Access Protocol (LDAP) for user configuration and authentication
- Health Insurance Portability and Accountability Act (HIPAA) regulation, with role-based privilege assignment and access control.

Remote Connectivity

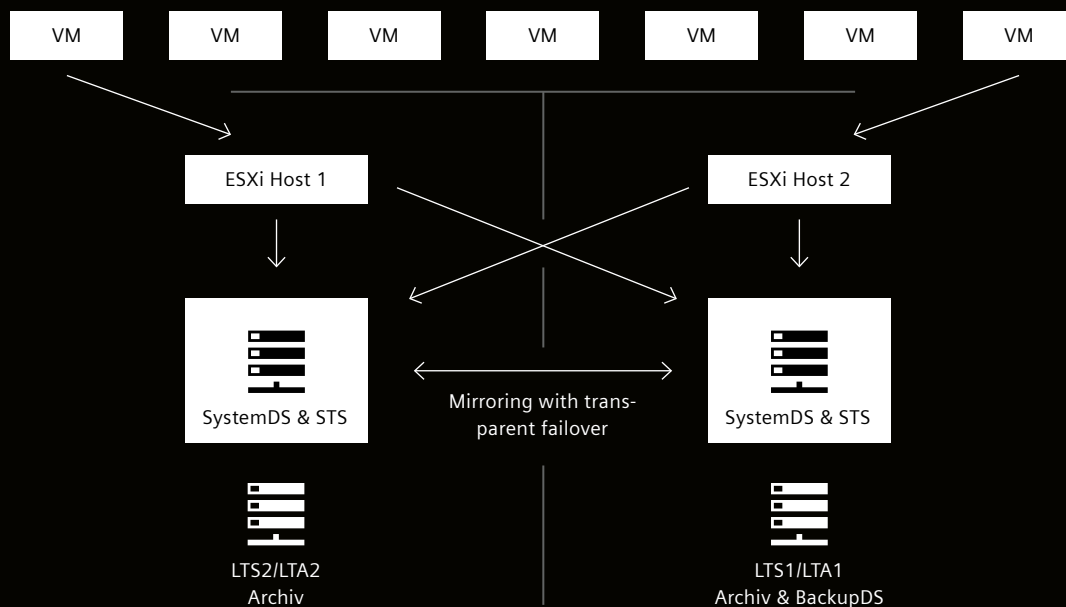
A secure channel is dedicated to the Siemens Healthineers Remote Service connection. The channel is used to download security patches and updates, among others. If desired, utilization events (not containing Personal Health Information PHI/PII) will be published to the Siemens Healthineers headquarters as part of the configuration.

Continuous Vulnerability Monitoring

- Syngo Carbon solutions perform continuous vulnerability assessment and remediation throughout the entire product life cycle. Our software development processes, quality management and change management are certified according to EN ISO 13485 and EN ISO 9001, which encompass an expansive risk-management protocol for new and changed requirements. We analyze risk analysis and identify control measures with a particular focus on data security and patient safety.
- Syngo Carbon solutions actively participate in the Siemens Product and Solution Security initiative to ensure that cutting-edge security measures are followed. It immediately identifies and mitigates upcoming risks.
- As part of the scope of an information security management system (ISMS), threats and vulnerabilities of third-party products such as virtualization environments, operating systems, databases and software libraries are constantly monitored using reliable sources. General advisories come from CERT for example, and specific advisories come from Siemens CERT. The development process follows the requirements of the IEC 62304, IEC 82304 and EN ISO 14971.



Software, Hardware and Virtualization for Syngo Carbon Core



Solution Design

The Syngo Carbon Core provides a minimum of complexity. It unites the intuitive reading and reporting, and the robust, highly scalable image and data management, in one space. From the smallest installations with a few scanners and a couple of terabytes of data, to large regional solutions with hundreds of data sources and petabytes of storage, Syngo Carbon can power it all. Our hardware solution design scales to your needs – from single hospitals to multi-site networks, from single boxes to highly-available multi-site clusters. Our systems are fully virtualized and offers monitoring and business continuity.

One Room/Single Server

The one room/single-server deployment consists of a single server system with a VMware ESXi Hypervisor that also includes the SystemDS and STS data storage. Also included in this configuration are the storage server systems, i.e. systems for long-term Storage (LTS) or long-term archive (LTA). The one-room/single-server solution is the entry-level virtualization platform for the Syngo Carbon software products.

One-Room/One-Site High Availability (HA) Cluster

The one-room/one-site High Availability (HA) cluster deployment contains of at least two server systems that are connected to a shared storage system. The storage server system – systems for long-term storage (LTS) or long-term archive (LTA) – are also part of the configuration. This is the entry-level high-availability solution on the virtualization platform for Siemens Healthineers Products. The system's built-in redundancy covers potential host outage.

Two-room/Two-site High Availability (HA) cluster

The two-room/two-site High Availability (HA) cluster deployment consists of at least two computer server systems that are connected via a storage network to a shared storage HA cluster. This meets the mirrored storage Logical Unit Numbers (LUN) and volumes required and includes a transparent failover to the host server systems. The storage server system – systems for long term storage (LTS) or long-term archive (LTA) – are also part of this deployment.

Virtualization

Virtualization technology is the basis for running workloads on either a private data center or the cloud. Syngo Carbon is building on state-of-the-art virtualization and container-orchestration technology to optimize:

System Resiliency

The use of clustering technology helps mitigate hardware and software failures. Higher levels of resiliency require adding redundancy to the hardware setup.

Improved Operational Efficiency

A unified management experience and automated software updates help drive operational costs down.

Ability to Scale

Being able to add computing and storage resources in case of an increasing demand safeguards infrastructure investment.

Efficient Usage of System Resources

Increasing workload density by using containers and automatic resource balancing improve hardware utilization.

Business Continuity

A business continuity plan is needed to ensure the capability of continuous business with minimal operational downtime.

Business continuity has to cover failure and emergency cases, which includes restoring

a system to its previous state. Several business continuity options are available to meet the availability demands specific to each enterprise.

Disclaimer

- ¹ Syngo Carbon Core consists out of the medical device Syngo Carbon Space, which builds the Workspace part, and non-medical device syngo.share core, which builds the Image and Data Management part of Syngo Carbon Core. Syngo Carbon Space is a medical device and not yet available in all countries. Due to regulatory reasons, future availability cannot be guaranteed. Please contact your local Siemens Healthineers organization for further information. Syngo Carbon Image and Data Management is enabled by syngo.share. syngo.share consists of several non-medical components of ITH icoserve technology for healthcare GmbH, Innsbruck, Austria. syngo.share products are not commercially available in all countries and their future availability cannot be guaranteed due to regulatory reasons. Please contact your local Siemens organization for further details.
- ² Syngo Carbon Advanced Visualization enabled by syngo.via
syngo.via can be used as a standalone device or together with a variety of syngo.via-based software options, which are medical devices in their own right. syngo.via and the syngo.via based software options are not commercially available in all countries. Due to regulatory reasons its future availability cannot be guaranteed. Please contact your local Siemens organization for further details.
- ³ Syngo Carbon Dynamics Visualization enabled by syngo Dynamics
syngo Dynamics WebViewer is designed for viewing only, not diagnostic use.
- ⁴ AI-Rad Companion consists of several products that are (medical) devices in their own right, and products under development. AI-Rad Companion is not commercially available in all countries. Future availability cannot be ensured.
- ⁵ Siemens Healthineers Digital Marketplace is not commercially available in all countries. If the services are not marketed in countries due to regulatory or other reasons, the service offering cannot be guaranteed. Please contact your local Siemens Healthineers organization for further details.
- ⁶ Siemens Healthineers is neither the provider nor reseller nor legal manufacturer of the 3rd party applications in Siemens Healthineers Digital Marketplace. Any claims made for 3rd party applications as well as the content and all warranty obligations are the sole responsibility of the legal manufacturer and not Siemens Healthineers. The product names and/or brands referred to are the property of their respective trademark holders. Additionally, the 3rd party applications mentioned may not be commercially available in all countries. Due to regulatory reasons its future availability cannot be guaranteed. Please contact your Siemens Healthineers representative or 3rd party application team for more information and further details about the product and its availability in your country.
- ⁷ teamplay is not commercially available in all countries. If the services are not marketed in countries due to regulatory or other reasons, the service offering cannot be guaranteed.
- ⁸ Not yet commercially available in all countries. Due to regulatory reasons, its future availability cannot be guaranteed. Please contact your local Siemens organization for further details.
- ⁹ Syngo Carbon Open Access enabled by syngo.via OpenApps
- ¹⁰ Syngo Carbon Innovation and Research enabled by syngo.via Frontier
- ¹¹ syngo.via, syngo.via Frontier, and the Digital Marketplace are not yet available in all countries. Due to regulatory reasons, future availability cannot be guaranteed. Please contact your local Siemens Healthineers organization for further information. syngo.via Frontier Research Prototypes are for Research Only. Not for Clinical Use.
- ¹² The pulmonary density functionality is not commercially available in all countries, and its future availability cannot be ensured. As soon as this functionality is available and cleared for your country it will become entitled to your institution. The Pulmonary Density feature is new in VA12A without FDA Clearance. According to FDA policy "Enforcement Policy for Imaging Systems During the Coronavirus Disease 2019 (COVID-19) Public Health Emergency" issued in April 2020, the manufacturer is allowed to market this feature without FDA-clearance. This policy is intended to remain in effect only for the duration of the public health emergency related to COVID-19 declared by the HHS, including any renewals made by the HHS Secretary in accordance with section 319(a)(2) of the Public Health Services Act (42 U.S.C. 247d(a)(2)). Pulmonary Density results are not indicated for the diagnosis of COVID-19. Only in vitro diagnostic testing is currently the definitive method to diagnose COVID-19.
- ¹³ syngo Workflow SLR and Medicalis Workflow Orchestrator are not commercially available in all countries. Due to regulatory reasons, its future availability cannot be guaranteed. Please contact your local Siemens organization for further details.
- ¹⁴ Syngo Carbon Remote Scanning enabled by syngo Virtual Cockpit
- ¹⁵ syngo Virtual Cockpit is not commercially available in all countries. Due to regulatory reasons its future availability cannot be guaranteed. Precondition: Expert-i enabled modality from Siemens Healthineers.
- ¹⁶ Appropriately trained personnel operating under applicable federal, state, and local laws as to the specific imaging modality(ies), including radiation and contrast.
- ¹⁷ Syngo Carbon Patient Access syngo.share patient access portal
- ¹⁸ Syngo Carbon Physician Access is a web version of Syngo Carbon Space.
- ¹⁹ Syngo Carbon Encounter-based Imaging enabled by Visual Capture App
- ²⁰ Visual Capture is a product of ITH icoserve technology for healthcare GmbH - A Siemens Healthineers Company, Innsbruck, Austria. This product is not to be used for diagnostic purposes. The product offering is not commercially available in all countries. Please contact your local Siemens Healthineers organization for further information.
- ²¹ teamplay products are not commercially available in all countries. Due to regulatory reasons their future availability cannot be guaranteed. Please contact your local Siemens Healthineers organization for further details.
- ²² Availability depending on data privacy settings and regulations
- ²³ Availability of benchmarking option depends on a minimum number of considered subscribers to guarantee customer anonymity and data protection.
- ²⁴ All applications can be accessed from a tablet, teamplay Fleet can also be accessed from a mobile phone
- ²⁵ Syngo Carbon Image and Data Management enabled by syngo.share core
- ²⁶ Syngo Carbon Archiving enabled by syngo.share VNA
- ²⁷ The products/features and/or service offerings (here mentioned) are not commercially available in all countries and/or for all modalities. If the services are not marketed in countries due to regulatory or other reasons, the service offering cannot be guaranteed. Please contact your local Siemens Healthineers organization for further details.
- ²⁸ PEPconnections: Subscription required. Availability of subscription depends on country.
- ²⁹ Remote Assist: Prerequisites: stable SRS connection with adequate bandwidth.
- ³⁰ To benefit from smart connections between teamplay Fleet and other teamplay applications, it is mandatory to have an account for both applications.



Syngo
Carbon

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