



# Medicis

## Medicis - healthcare assistance from home, office, and outdoors

Stallios presents Medicis, the revolutionary healthcare solution that allows the world to finally enjoy seamless human-like AI-based healthcare assistance from the home, office, and outdoors. From now on, healthcare assistance is something you can have instantly, from the comfort of your living room, business office, and outdoor sites. Thus, no more expensive traveling, and waiting for hours or days to get your medical consultation, x-ray, diagnosis, and prescription. All you need to enjoy Medicis is a modern PC or smartphone with a camera.

### The problem

Considering that efficient healthcare assistance to the public has always been something extremely complex to achieve, and considering that many people around the globe, each year, young and old, lose their lives because of a lack of proper healthcare assistance, the medical world needs an efficient solution to improve this situation. Usually, the causes of the lack of proper healthcare assistance are almost always related to a lack of budget, resulting into a lack of medical personnel and equipment.

Either in the private or public sector, no matter your working class or annual income, healthcare assistance is something extremely expensive that many people can't afford, even when our life is in danger sometimes. And when we can afford healthcare, the waiting time and delay before we can get any assistance are always long, and sometimes we may need instant assistance outdoors, and instant self-service healthcare assistance doesn't exist. Thus, something has to be done to overcome those monumental problems, and offer instant and efficient healthcare assistance to everyone on the planet.

## The solution

Thanks to the progress of computer-science and advanced artificial-intelligence, Stallios has designed and engineered Medicsis, a next-generation intelligent AI-based and interactive healthcare and EHRP solution, in order to improve general healthcare assistance globally. In terms of its current features available, Medicsis is a complete EHRP and hospital management solution with all the useful features the medical sector would expect, that is integrated with Mayca, our super-AI with vision and speech.

Mayca acts as a virtual doctor, in order to offer seamless and efficient human-like healthcare assistance to patients via their PC or smartphone, either online or offline, without any internet connection. Mayca can also assist clinicians efficiently in their work, either to guide them on the EHRP platform's navigation, or to answer any types of complex medical and health-related questions. The current version of Medicsis is 2.0, and the next versions will be: 2.01 up to 3.0 after 12 months of engineering. During those versions, we plan to add new features, and finally integrate Mayca into the system. See the video demo and PDF document about Mayca, our super-AI solution.

During the consultations, Mayca will greet the patients warmly by their name, and ask a series of questions in order to understand their medical problems like a real human doctor, and take some x-rays via their PC or smartphone's camera if necessary, and come up with a diagnosis and prescription. Mayca can serve many patients simultaneously. For example, if we have only one human doctor available to assist 1000 patients who need medical assistance at the same time because of an emergency, Mayca will be able to assist all those patients easily, like one patient, and send the diagnosis and x-rays to the human doctor, to be verified and approved.

If a patient is in a critical condition, Mayca will see it and understand the patient's situation, and contact the emergency department right away, in order to ask the doctors to assist the patient accordingly. Medicsis, including Mayca, our super-AI solution, have not been created to replace human doctors and registered nurses in any way, and this is not the goal of the system. However, our solution is designed and engineered to satisfy many needs related to healthcare assistance, and efficiently improve productivity in the medical sector globally.

## License cost

\$25,000,000.00/per year - the license covers one province or state, and includes everything turnkey.

- The Medicsis solution that runs as a SaaS but on-premise.
- A brand new 5 million dollars IBM Z-16 supercomputer dedicated to your organization only.
- The installation of the IBM Z-16 supercomputer, including the installation of the Medicsis solution.
- A team of 6 full-time AI engineers working at your service for the overall system maintenance, and to design and engineer software modules for you as add-ons to extend the system for your needs.
- The system installation and configuration takes around 3 to 12 months.

## Technical description summary

- Next-gen EHRP and hospital management solution with all the useful features expected by clinicians
- Advanced super-AI system with speech and vision integrated, to assist patients, and clinicians' work
- Interactive healthcare assistance to patients via PC and phone, from home, office, and outdoor sites
- Interactive healthcare assistance to patients includes consultation, x-ray, diagnosis, and prescription
- Fully modular, allowing users to view their desired home page and modules based on their needs
- Fully HIPAA-compliant, and follows the SOAP, including all the other international medical standards
- Integration of international classification instruments: ICPC/2, ICD-10, DSM-4, LOINC, SNOMED
- RxNorm-based multi-lingual drug-interaction detection (interfaced to National Library of Medicine)
- 3BT clinical thesaurus with validated coding aid for ICD-10 and ICPC-2
- Snomed CT coding (diagnoses) system integrated
- Integration of DCM4CHE/ Weasis-based PACS and DICOM-viewer solution
- HL7/ FHIR API for structured data exchange with external applications
- Preventive medicine with vaccination planning and campaigns system integrated
- Medical imaging management with pathology lab system integrated
- Financial management with invoicing, payments, and cash transfer system integrated
- Printing of medical records, invoices, and prescription labels system integrated
- Advanced lab order entry and results management (LOINC coding supported)
- HL7-based interface with Lab analyzer middleware solutions (Abbott AlinIQ / AMS)
- Advanced statistics of the population's health, co-morbidity, costs of care, and many more
- Advanced billing system with public and private health insurance management integrated
- Advanced diagnosis prediction and probability system based on symptoms to assist clinicians
- Fingerprint identification system integrated using Digital Persona library
- Open to the integration of other clinical as well as financial and administrative applications
- Pharmacy system integrated with intelligent auto-management of medication inventory
- Advanced in-patient and out-patient management system integrated
- Mental-health assistance system with symptoms and diagnosis prediction system integrated
- Management system for patient beds, rooms, and wards integrated
- Advanced human resource management system integrated
- Advanced scheduling system integrated, available for logged-in patients, and clinicians
- X-ray, laboratory, and pathology order entry and results management system integrated
- Complete Admission, Discharge and Transfer (ADT) management
- Integrated solution for archiving scanned documents
- Audio-video meetings integrated for tele-consultation with patients, and for clinicians' meetings
- Audit logging for all actions and transactions in the system for easy consultations
- Security system integrated with access identification, access monitoring, and intrusion detection
- Fully independent, redundant and reversible, on-premise SaaS solution built to avoid global outages
- Available in English, French, Dutch, Spanish and Portuguese
- Fully web-based SaaS solution optimized for all PC and smartphone devices
- Engineered to run online or offline without any internet connection, and sync data when connected
- Turnkey fully-managed solution, backed by a team of full-time engineers, technical, and medical staff
- Runs on \$5 million IBM Z-16 supercomputers built for highly-secure mission-critical operations

## Interactive self-service healthcare to patients

Medicis offers interactive self-service healthcare to patients vocally via Mayca, our super-AI shown below, that acts as a virtual-doctor, or via a user-friendly question-answer interface also shown below, that allows patients to get an instant diagnosis for their medical problems by selecting their symptoms. Medicis will also suggest to patients the next steps to follow in order to solve their health problems.



Do you have "fatigue and tiredness"?

☐ Yes

☐ No

Do you have "increased hunger and thirst"?

☐ Yes

☐ No

Do you have "need for peeing very often"?

☐ Yes

☐ No

Do you have "itchy and dry skin"?

☐ Yes

☐ No

Do you have "blurred vision"?

☐ Yes

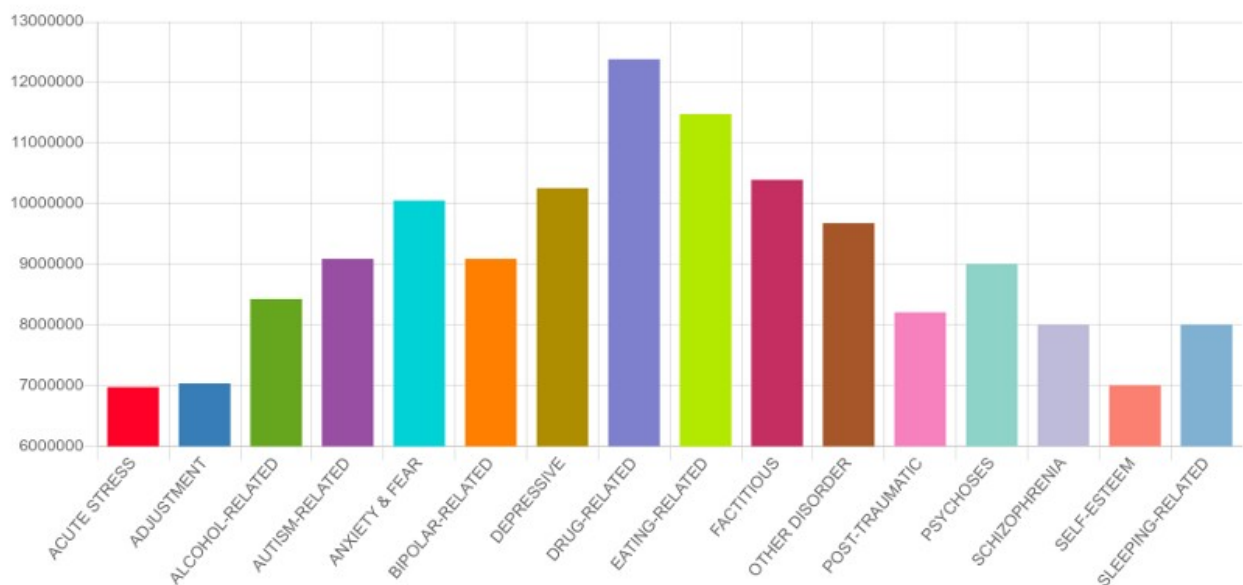
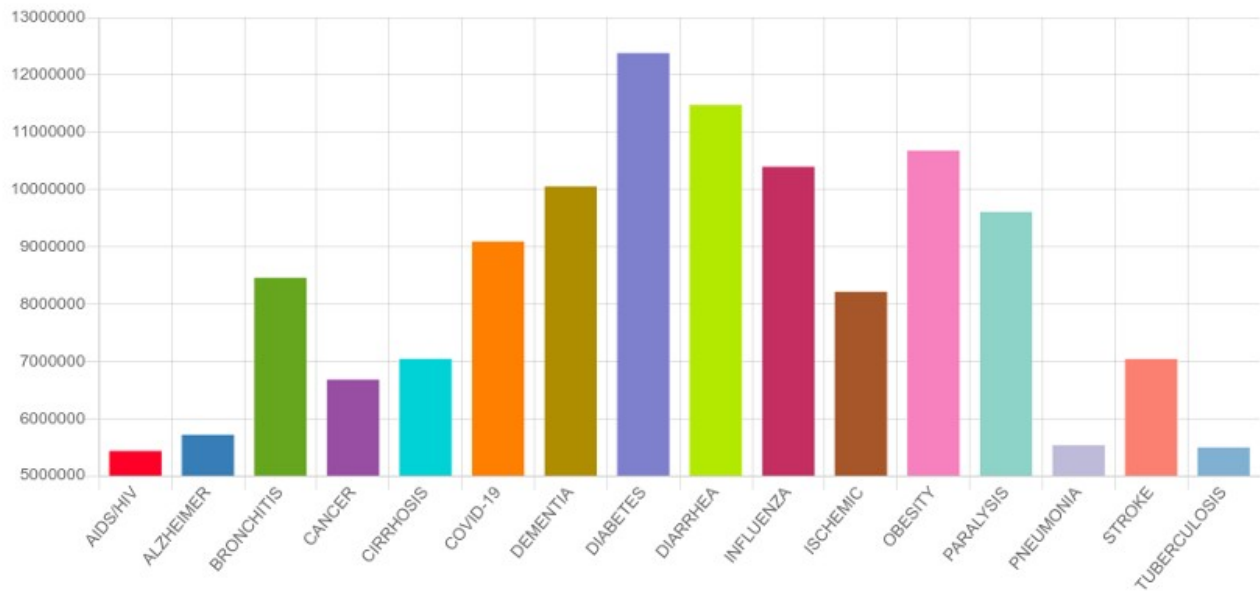
☐ No

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## Real-time health monitoring of the population, and the armed forces

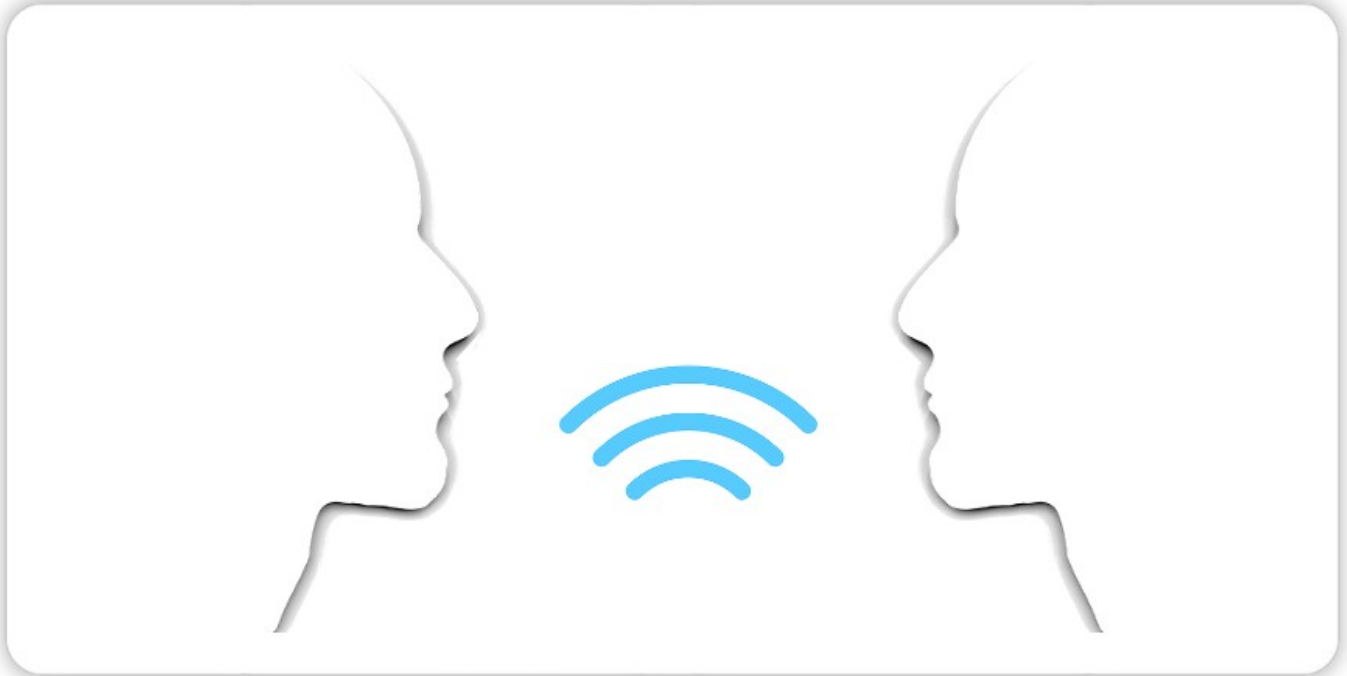
Medicis allows you to monitor the health of the population, and the armed forces in real-time, via a modern user-interface displaying all active illnesses, and the number of patients affected per province, city, gender, age, etc. Medicis will also contact the clinicians to report any abnormal spikes of illnesses detected. This feature allows clinicians to take fast action for any type of health emergency in the population. Medicis also offers the possibility of viewing advanced statistics about a wide range of other topics, covering almost all the departments and topics in the system, and more can be added.





## Live conversations with health data and documents

Medicis allows clinicians to have live conversations with all types of health data and documents, in order to have accurate answers to any complex health-related questions you have. This is done vocally via Mayca, our super-AI solution. For example, instead of searching manually for some specific information about a patient, you can simply ask Mayca about it, to have a fast and accurate answer. This feature is also very suitable for doing interactive business-intelligence vocally, in order to have live conversations with your clinic, hospital, and organization, like if you were talking to a living entity.



## Medical decision support for clinicians

Medicis offers a powerful feature to assist clinicians with the diagnosis of their patients. Clinicians have access to an advanced module that allows them to select a range of symptoms for any type of illness, in order to have the best diagnosis by AI-prediction for that illness, including other useful information such as the full range of symptoms, medication available, and the medical ICD-10 code for that illness. Please see the video demos of the medical decision support in Medicis for more details.

## Source of the medical decision support

The source used as a basis for medical decision support by clinicians, is a local diagnosis prediction module that is part of the Medicis system itself, and fully integrated into its code-base. The same prediction module as been used for all the clinical support demo videos included in this presentation.

## Secured with data encryption and monitoring

Medicis is a HIPAA-compliant solution, where all databases and archives data are kept encrypted. Only the owner of the data in question, including the users who have permissions to have access to that data, based on their role in the system, can have access to the data. Also, the system has many integrated security features to protect the data and privacy of the users of the platform. Such as site monitoring, activity logs, and intrusion detection that will ban a user IP after too many failed log-ins.

## Modular EHRP solution with user-roles

Medicis is an extremely large and complex platform offering many features to a wide audience of different types of users. From patients to clinicians, from epidemiologists to lab researchers, from radiologists to system maintenance staff, and more. It is obvious that each of those users will have specific needs and permissions when they log into the system. In terms of what features they can have access to, and also what type of content they can share with others. Therefore, Medicis offers the possibility to easily create new user-roles, permissions, and features available per user-role, simply by enabling or disabling specific modules in the system. For example, to enable or disable the Covid-19 module, you can select: system > my profile > change default page > select module > save. Please see the video demo of the module management in Medicis for more details.

## Engineered to avoid global medical outages

Many clinics and hospitals around the world are still struggling following the loss of their health records caused by the last global outage in the medical sector. Unfortunately, this is something that can happen again anytime, because of the way the medical sector is structured in terms of their health records, which relies completely on one OS supplier who is not perfect, and prone to critical errors like we saw a few months ago. Those types of irreversible global outages by error are not responsible at all, and should never happen in the medical sector. Medicsis is engineered to be an independent, redundant and reversible, on-premise SaaS solution running on highly-secure mission-critical supercomputers engineered to avoid those types of critical and irreversible global outages by error.

## Fully-managed turnkey SaaS service

Medicsis is a fully-managed on-premise SaaS solution. As soon as a customer purchases a license, the IT infrastructure, including an IBM Z-16 supercomputer, will be installed on-premise at the client's location of choice. This infrastructure includes the Medicsis master software that is accessible via HTTP or VPN, from any PC or smartphone web browser. The customer will also receive a username and password to log into the Medicsis system as super-admin, in order to create user-roles with specific modules, features, and permissions. Additionally, it is possible to run the Medicsis software in slave-mode with all the features, either online, or offline without any internet connection, and sync its local data to the Medicsis master living on-premise, when the internet connection becomes available.

## Engineered for robustness, scalability, and durability

Medicsis is engineered with high-standard and proven technologies for speed, robustness, scalability, and durability. The system is fully modular, in order to accept any new custom features, as well as any new technology integration in the future. Additionally, Medicsis offers a wide range of statistics and business intelligence features, especially engineered to continually monitor its performance, quality of service, operational costs, and much more. All those attributes make Medicsis a best-in-class system built for performance, and that will evolve without limit in the years to come.

## The next-generation EHRP and hospital management

One of our missions at Stallios is to offer the next-generation healthcare assistance to the world that patients and clinicians worldwide will enjoy using because of its ease-of-use, usefulness, robustness, and aesthetic design. Medicsis is not just another simple health-records software, but one of the most advanced and complete EHRP and hospital management solutions, especially engineered to be the very best healthcare solution available on the planet. Allowing the medical sector around the globe to integrate next-generation healthcare assistance into their infrastructure, the right way.



## Patient administration

Efficient patient administration is one of the cornerstones of a well-designed Hospital Information System. Patients must be uniquely identified, in order to keep track of their complete medical and financial history within the institution.

The Medicsis' patient administration module has been designed to enable registration of a complete administrative history. Nevertheless, as special (local) needs for particular data fields may arise, the module is easily extensible. Any number of data fields that would seem to be missing in the standard implementation can be added to the system by the application manager.

### Patient identification

Patient identification is crucial when handling sensitive personal information like medical or financial records. The Medicsis patient identification features include:

- Multi-criteria (names, date of birth, ID-numbers, archiving number, address, phone number, ID number...) patient retrieval engine, which can be configured according to site-specific.
- Possibility of storing an electronic picture of the patient using standard webcam equipment.
- Possibility of linking health records to other health records based on family relationships (mother - child, spouses...).
- Possibility to attribute an unlimited number of person identifiers to a patient record (ID card, National registration ID, Passport ID etc...).
- Possibility to add fingerprint ID to Medicsis. This ID is a unique transformation of the patient's (or user's) fingerprint into a person identifier through the Digital Persona Software Development Kit. For each patient, a maximum of 10 fingerprint vectors can be stored (one for each finger).
- Automatic attribution of a unique, permanent system-wide medical record number by Medicsis to each patient. This ID is the key that brings together all person-related information that is brought into the system. Every person-related document that is printed by Medicsis can wear this unique ID. Possibility to print patient identification labels to put on paper documents, wristbands etc... This printout also comprises bar-coded tags, which can reduce patient identification time dramatically. Code 39 (3 of 9) is proposed as the default bar-code technology. Code 39 is widely used in many industries and is the standard for many government bar-code specifications. Medicsis provides a function for generating bar-coded patient and health facility staff identification cards, which can be printed on credit-card sized plastic cards using appropriate printing equipment and supplies.
- In addition to Medicsis' strong identification mechanisms, clinicians also need to be actively involved in the development of policies and procedures related to verifying patient identity. Clinicians can best identify issues that contribute to error-prone conditions and develop strategies to reduce their likelihood. Next, they must consistently follow the procedure and be accountable for their practice by adhering strictly to the policy. Furthermore, clinicians must hold each other responsible and continually identify risk states and implement processes and procedures to prevent such errors. Nurses should review existing policies, procedures, and practices related to patient identification. They need to

identify gaps and situations that place patients at risk and then develop and implement processes to minimize these risks. In many situations, current practices are not adequate to address the pace of admissions and number of surgical cases. Many times, the clerk in the admission office charged with placing a name band does not understand the risks inherent in incorrect identification. These human factors should be adequately addressed during the training sessions that will accompany the information system implementation. If for some reason a patient ends up with more than one medical record in the institution, Medicsis provides a record merging function, resulting in a fusion of two records into one single record. An automatic retrieval engine for records that are 'suspicious' (possible duplicates), facilitates the maintenance of a 'clean' administrative database.

## Demographic data

Most common patient-demographic data elements have been integrated into Medicsis such as:

### Personal data

- Name (first name, last name, alternate names)
- Date of birth
- Record ID number (other than the attributed Medicsis ID, e.g. reference to a paper based record)
- National ID number
- Language
- Gender
- Place of birth (city and country)
- Nationality
- Alternate ID (e.g. fingerprint or other biometric data)
- Comments
- VIP status (restricts access to specific users)

### Medico-administrative data

- Family physician
- Other private physicians (specialists)
- Health Insurance company
- Health Insurance Contract number
- Health Insurance status (code + description)

### Official address data

- Street and number
- Zip-code
- City
- Country
- E-mail
- Telephone and Fax
- Mobile phone
- Comments

## Occupational or work data

- Employer name and address
- Employee record number
- Work e-mail
- Work telephone
- Work fax
- Work mobile phone
- Function
- Employee category
- Start date of employment
- End date of employment

## Admission, Discharge, and Transfer (ADT)

The Medicsis ADT module enables the detailed follow-up of all patient movements within the healthcare facility. Data collected in this module will also be used to calculate bed occupancy rates or provide reports on the actual numbers of available beds.

### In-patients

Every contiguous period of time a patient occupies a bed in the hospital, is identified by a unique admission number. Every medical act, prescription, payment etc... related to the hospital stay will carry this Admission ID. The Admission number being unique, it can also be used to uniquely identify a patient within the system.

### Admission identification

At the admission of a patient, a number of admission-related data can be collected and stored in the Medicsis system. The Medicsis implementation holds the following and optional data:

- Date and time of admission
- Origin of the patient
- Planned date and time of discharge
- Room identification
- Bed number identification
- Responsible physician identification
- Diagnosis at admission
- Source
- Comments
- Beds can be fully identified within Medicsis, with the ability to add an operational status (operational, non-operational) and GIS information. Based on stored admission data, patient census reports can be generated in real-time by any authorized user of any room.

## Transfer

A transfer in Medicsis means a change in room or bed identification data within the context of one and the same hospital admission. Transfer registration is essential to keep track of bed occupancy and availability. On the occasion of a transfer, the following data can be entered (some are optional):

- Date and time of transfer
- New room identification
- New bed identification
- New responsible physician identification
- New planned date and time of discharge
- Reason for transfer
- Destination, Comments
- A unique transfer identification number is automatically attributed to every transfer in the hospital.

## Discharge

A Discharge means the end of a hospital admission. After discharging a patient from the hospital, the admission number is closed, and the occupied bed is automatically flagged as 'available' by the Medicsis system. When discharging a patient, the following data can be entered (some are optional):

- Effective date and time of discharge
- Reason for discharging the patient
- Destination of the patient
- Discharge diagnoses
- Outcome, Comments
- At discharge, the Medicsis software enables the automatic calculation of hospital stay costs based on tariffs associated to the departments and rooms occupied by the patient during the admission period.

## Out-patients

Visit identification for out-patients. Every visit to the hospital is identified by a visit identification number. This number will enable the grouping of all patient data related to one and the same hospital visit. When registering an out-patient's visit, the following data can be entered into the system (some are optional):

- Date and time of the visit
- Department
- Reason for encounter
- Origin of the patient
- Type of contacts (consultation, examination) to be carried out
- Contact type
- Responsible clinician
- Scheduled contact time
- Category of contact (natural illness, occupational health problem, work accident, traffic accident.)
- The type of contacts refers to the reference table for medical acts, enabling preliminary invoicing of outpatients at the moment they present themselves at the hospital registration desk.

## Patient tracking

Patient ADT information permits you to keep track of the patients' movements within the hospital. A separate module is provided by Medicsis to visualize inpatients' bed allocation history and to identify all medical acts which adhere to a specific time of the admission period. Medicsis can also show a map of the hospital site with the exact location of the patient's allocated bed at any moment.

## Scheduling and appointments

A standard electronic agenda has been integrated into Medicsis. This user-centered agenda can hold all scheduled appointments for every user, permitting the definition of 'user groups' which are granted access to each other's agenda. The medical record of a patient can then easily be opened by clicking on the patient's name in the agenda (quick identification). The patient's appointment history can easily be consulted through the 'patient schedule view'. This view provides access to upcoming, passed and missed appointments. When opening a patient's health record in Medicsis, upcoming appointments are also immediately visible on the health record summary screen.

Appointments which have been canceled or rescheduled remain available in the history of the system, enabling later reporting on cancellation frequencies per department and per user/care provider. A number of scheduling features can be configured on a per-user basis:

- Time slots can be marked available or unavailable in every user's or resource's agenda
- Default time increments can be defined per user and are easy to modify or overrule when needed
- Public holidays and care provider leave can be programmed in advance, making the corresponding time slots by default unavailable for appointments
- Text-based instructions and structured information on planned examinations can be attached to each appointment
- The scheduling module allows for automatic generation of the next available time slot based on user-specific configurations and also permits the registration of unscheduled appointments which are then assigned a walk-in sequence number as well as a priority indicator.
- Walk-in contacts are handled in a separate module which allows processing of patient contacts ordered by priority indicator/sequence number combination (queue management system).
- Appointment reports can be printed per user, per patient or per resource for any given period. Default reports are also available for printing upcoming appointments for a specific patient or for a specific user.

## Resource planning

In the Medicsis agenda, a resource planning facility has been integrated. This module enables users to make reservations for shared resources such as rooms, diagnostic devices, meeting rooms etc. which can greatly facilitate the administration of their use on a "first come first served" basis.

## Financial management

Financial management in Medicsis is based on health services-based billing. This means that invoices for hospital visits (outpatients) and hospital admissions (inpatients) can be generated based on provided medical and technical procedures, consumables, medicines etc. which have been linked to a specific Visit ID or Admission ID.

### Activity data

Accountable health services (medical and technical procedures and other care deliveries) can be provided to the system in multiple ways:

By manually adding care deliveries to the patient record. This manual coding of care deliveries may use different data entry screens:

- Individual care delivery coding using a multi-criteria search engine for retrieving applicable care deliveries
- Macro-based coding, where a single code can be used for generating a common set of care delivery items
- Multi-column and multi-row tick-box based coding for fast coding of the most common care deliveries
- By automatically generating act codes based on medical record data entry. The Medicsis software contains a sophisticated module to link specific acts to medical record activity. E.g. the output of a laboratory result or an X-Ray report will automatically generate the corresponding act codes. But also medication prescriptions, vaccinations and intellectual activities can be linked to delivery-codes. This link is rule-based and can be maintained by the local application manager. Billable care deliveries that are automatically generated by the system, still have to be validated by a dedicated user in order to make sure that (default) health insurance policies have been correctly taken into account.
- For every care delivery, the following data can be added to the Medicsis system (in supplement of all data imported from the care delivery reference table):
  - Planned flag to indicate that the act has been planned.
  - Executed flag to indicate that the act has been executed.
  - Validated flag to indicate that the act has been validated by a user.
  - Department that generated the care delivery (pre-programmed defaults can be overridden)
  - Care provider linked to the care delivery (pre-programmed defaults can be overridden)
  - Quantity of the specific care delivery
  - Health insurance scheme and applicable tariff
- Complementary insurance coverage and/or health program-specific reimbursements. Care deliveries that are manually added to the system will automatically have the 'validated' flag set. The 'executed' flag is set for care deliveries, which are automatically generated from medical record data entry. Care delivery codes can easily be grouped into so called 'care delivery profiles'. These profiles are stored into the Medicsis database and can be used to quickly add groups of act codes to the medical record (e.g. several laboratory analysis grouped together)



## Invoicing and accounting

The Medicsis invoice module is patient centered. This means that only invoices related to a patient can be printed by the system. Invoices for a particular patient can be selected on a series of criteria:

- Admission ID-based invoicing
- Visit ID-based invoicing
- Specific period of time
- Selection of specific care delivery codes
- Manual selection
- By care delivery code
- By care provider (user responsible for the care delivery)
- Activity code flags (planned, executed, validated)

All criteria can be combined, yet provide a very flexible way of outputting invoice data for specific situations. For every invoice, the following data will be recorded (in supplement of the data retrieved from the medical record):

- Date and time of the invoice
- Identification number of the invoice (automatically generated by the system)
- User generating the invoice
- Department generating the invoice (optional)
- Total amount of accountable care deliveries
- Total amount of payments already registered
- Balance
- Destination of the invoice (patient, employer, insurance company...)
- Health insurer reference and reimbursement authorization numbers
- Health insurer invoices can be printed or exported in PDF or CSV/Excel format for automated integration in health insurer information systems. Patient invoices are most often printed out, systematically generating in a typical setting a separate patient receipt in addition to the invoice

## Discharge and end of visit

At the moment of discharge or when closing a visit, a final invoice for the hospital stay or visit can be printed out. This invoice holds all accountable care delivery data related to the Visit ID or Admission ID and for which the 'validated' flag has been set. Cash transfer history related to the Visit ID or the Admission ID is included in the invoicing module. This means that the invoicing module will subtract all registered pre-payments from the amount due, and it will print out the balance on the invoice.

## Preliminary invoicing

Preliminary invoices related to a Visit ID or an Admission ID can be printed out, holding all accountable activity codes for which the 'planned' flag has been set. Cash transfer history related to the Visit ID or the Admission ID is included in the preliminary invoicing module. This means that the invoicing module will subtract all registered payments from the amount due and print out the balance on the invoice.

## Payment and cash transfers

The following types of payment and cash transfer have been integrated into Medicsis:

- Deposits
- Cash payments
- Other money transfers (health insurers)

For every payment or cash transfer, the following data will be recorded (some are optional):

- Visit ID or Admission ID
- Date, time, and origin of payment
- Amount, and Currency
- Wallet or cashier identification
- For every payment or cash transfer, a receipt can be printed out.

## Health insurance

Medicsis can handle an unlimited number of health insurers per health facility, an unlimited number of coverage plans per health insurer, as well as an unlimited number of applicable tariff plans. The software also covers concepts such as complementary insurance, reimbursement base and supplements, providing a very complete and flexible health insurance management environment that can cover the needs of many countries worldwide. Finally, Medicsis also integrates a module for recurrent automatic and unattended transmission of health insurance reimbursement claims to selected health insurance companies, enabling a fully electronic replacement for paper-based claims processing.

## Reference tables

Several reference tables, holding institution-specific data, have been integrated into Medicsis. Some of the tables that have already been integrated into Medicsis are: ICD-10, DSM-4 and ICPC-2 classifications and their corresponding thesaurus, the WHO essential drugs and lab analysis list, administrative structures (provinces, districts, towns etc...) for numerous countries. Other reference tables can be provided through SQL-views in the planned SQL-based database server.

## Health interventions and care deliveries

Tables containing the price list of care deliveries (medical and medical-technical acts, drugs, consumables...) are to be provided by the hospital. These reference-tables will be transparently integrated into the Medicsis interface. Medicsis provides a module for managing all care delivery related information. A permanent synchronization of this information with the financial accounting module is offered for the purpose of this solution. For every care delivery, Medicsis keeps track of different tariffs that may apply according to local health insurance and reimbursement regulations. It is worth mentioning that the supplier is committed to fully support the emerging WHO ICHI (International Classification of Health Interventions) standard from the day its first production release is available.

## Laboratory analysis

Medicis provides a standardized list of common laboratory analysis defined by WHO. The analysis list includes international LOINC-codes as a reference as well as pre-configured normal reference values for a generic sub-Saharan African setting. Modifications for better adapting the reference values to specific countries, alternative measurement units and different analysis equipment can be managed through a comprehensive and easy-to-use web-based system management interface.

## Drug lists

The standard edition of Medicis includes WHO reference tables for essential medicines with translations into English and French. The reference tables also include WHO ATC-codes, which refer to the active components in every drug. The default drug lists can be completed with local generic or specialized pharmaceutical compendia.

## Health insurers

Health insurers and their available health insurance coverage plans are being configured in the local Medicis implementation by the local application administrator. Health insurance coverage plans are bound to change quite often over time, and maintenance of these tables can easily be done by local staff without the need for any intervention from the supplier.

## Laboratory reagents and analysis procedures

Medicis keeps track of different lab analysis procedures (commonly called work lists) and reagents consumption logic related to these in special reference tables. By linking analysis procedures to individual lab tests, reagent consumption can be effectively predicted, monitored and controlled based on completed lab orders over user-configurable periods of time.

## Vaccination schemes

Medicis comes pre-loaded with the most common WHO vaccination schemes. These schemes can be adapted to local requirements whenever needed. This can be done by a local application administrator and needs no intervention from the supplier.

## Clinical terminology tables

A number of clinical data entry screens make use of structured and predefined clinical dictionaries. This has the advantage of assisting users to provide more standardized data entry, speeding up the data entry process and reducing typing errors. Clinical terms sets have been pre-loaded for a number of healthcare settings (health centers and district hospitals) but can easily be extended or modified to accommodate other care environments.

## Medical records

The medical record feature is the core object of the Medicsis system. In a hospital environment, accurate and persistent storage of clinical information is crucial to patients and care providers. Therefore, special attention has been paid to this extended module, for which the supplier can refer to more than 20 years of high-level experience.

### Record identification

Medical record identification is a complex matter. In some hospitals, patients have more than one medical record (e.g. service-based or functional multiplication of records). Sometimes medical records can only be identified by admission numbers or visit id's (time-based or temporal multiplication of records). In Medicsis, according to the adopted GEHR architecture, every patient has only 1 electronic healthcare record (EHCR). Information in this unique record can easily be aggregated in any form (per service, per room, time-based etc...) In other words, the Medicsis EHCR carries the same record identifier as the patient himself.

### History of health events

The standard patient medical history is summarized on a tab-based screen and contains:

#### Personal history

- Medications
- Alcohol & drugs consumption
- Tobacco usage
- Medical antecedents
- Surgery
- Accidents

#### Family history

- Marital status
- Children & medical antecedents
- Other family & medical antecedents

#### Occupational history

- Professional illnesses
- Work accidents
- History of relevant occupations & occupational risk factors
- Stress assessment

## Generic SOAP structure

For the purpose of entering data into the patient's medical journal, Medicsis provides a generic SOAP-based data-entry form. The SOAP format is used in most medical and allied health schools in the world. It stands for: Subjective, Objective, Assessment and Plan. Each of these sections requires a basic understanding of medical terminology to allow continuity of care. The SOAP format requires medical terminology that is considered appropriate by the facility where one is working. Each facility has a listed set of appropriate medical abbreviations and surgical abbreviations. Such a list can easily be integrated into Medicsis. The "S" includes the patient's goal, patient's pain complaint, medical history and social history. The "O" includes the clinician data collection of strength, range of motion, skin integrity, organ system function etc. The "A" includes the clinician's opinion about the presented case, prognosis, diagnosis and goals. Finally, the "P" includes the plan to progress to the goals set in the "A" and the interventions that are necessary.

## Domain-specific registration forms

Although generic SOAP notes might be sufficient for the majority of clinical documentation needs within the hospital, Medicsis permits the development of specific custom-made data-entry screens for special purposes. These data-entry forms are developed in close collaboration with the responsible clinicians, to make sure that the result exactly fits the specific documentation needs and business processes of individual departments. Examples of such specialized data-entry screen sets that have already been developed in the past are:

- General Practice
- Cardiology
- Internal medicine
- General surgery
- Gynecology
- Obstetrics
- Hematology
- Endoscopy
- Occupational healthcare
- Clinical laboratory
- HIV management
- Vaccinations management
- Disability and prosthesis management
- Department of emergencies
- Department of anesthesia & reanimation
- Department of surgery
- Department of gynecology-obstetrics
- Department of internal medicine
- Department of pediatrics
- Department of ophthalmology
- Department of stomatology and dental care
- Department of ENT
- Department of dermatology
- Department of kinesitherapy and orthopedics
- Department of Neuro-Psychiatrics
- Intensive Care Unit

## Selecting domain-specific clinical pathways

As we mentioned above, it is possible to select a specific clinical pathway for a consultation. For example, a clinician can choose to create a general SOAP consultation note for a patient, but a dentist will probably create a dental consultation note, or both, for a patient. Medicsis has many domain-specific consultation forms already available to use simply by selecting them, and more can be added on request. They're modular, ready and easy to use, without any editing needed. For example, a clinician can create a dentist note for a patient via the patient's profile by selecting the: SOAP medical notes icon > Other departments and their examinations > Dental care > Dental consultation > new.

## Medical prescription

Medication prescription management has been readily built-in into the Medicsis software. Medicsis also contains a built-in therapeutic WHO-referenced form, but for the purpose of the customer it may seem more appropriate to use a local form. Medication prescriptions typically hold the following data:

- Name of the prescribed drug
- Total quantity of prescribed drug units
- Number of prescribed drug units per day
- Begin date and end date of the therapy
- Dose and usage instructions
- Medical prescriptions can be printed out on paper bar-coded prescription forms or can be exported electronically in a structured or printable format (mainly for in-hospital prescription purposes).

## ICPC2/ICD10 based thesaurus

The complete ICD-10, DSM-4 and ICPC-2 classifications have been integrated in the standard edition of Medicsis. The Medicsis coding engine is available at all times in any data-entry screen. In order to make real time coding a feasible procedure, automatic coding is proposed for selected items in the domain specific registration forms. In that way, common symptoms, diagnosis, procedures and prescriptions can automatically be coded by the Medicsis package, thus avoiding misinterpretation of clinical notes in the final coding process.

A thesaurus in French and English (3BT) has been integrated into Medicsis for facilitating manual clinical coding, based on keywords and/or clinical concepts that can be entered by the user. Thereby, ICPC-2 and DSM-4 can be used as gateway-classifications, providing focused access to relevant subsets of WHO's large ICD-10 classification system (>11.000 illness and clinical condition codes). The 3BT thesaurus and code-mapping is being updated on a continuous basis and also enables the extension of above international coding systems with local coding and classification instruments (although such should be avoided whenever feasible).

## Technical examinations

Technical examination results and requests are treated by the Medicsis system just like any other medical documentation transaction. On the other hand, some specific modules have been added to the system to facilitate Computerized Physician-based Order Entry (CPOE).



## Lab analysis

A separate module is provided for configuring and managing lab analysis that can be ordered and performed by the health facility's laboratory. This module can be used by local application administrators or lab administrators and enables the management of the following data:

- Analysis code
- Measurement unit
- Normal reference values for different age ranges and genders.
- Analysis type (blood, urine, stool etc...)
- Description/label of the analysis
- Short name for the analysis
- Default reference value text to be printed on results forms regardless of age and gender-specific normal values (typically used for hormones)
- Sample type needed for the analysis
- Technical alert values beyond which the lab technician will be warned of a probable analysis error
- Lab analysis result editor to be used (text value, numeric value with limits, list-box, radio buttons, specialized editors such as for entering antibiogram results etc...)
- International LOINC code for the analysis
- Care delivery code to be linked to the analysis (used for automatic invoicing)
- Lab procedure linked to the analysis (enables calculation of lab reagents consumption)
- Lab results group (Hematology, Serology, Hormones...)
- Free text comments
- Availability of the analysis
- Visibility rules for the analysis results (general or restricted)

## Order entry

A complete and comprehensive laboratory prescription module is available in the standard edition of Medicsis. The most important features of the module are:

- Usage of a lab analysis reference table, specifying every available analysis.
- Possibility to use lab analysis profiles/templates (e.g. sets of analysis that go together for certain pathologies, investigations etc...)
- Availability of configurable order entry screens which map onto familiar paper-based lab order forms.
- This can greatly speed up the process of lab order entry for physicians.
- Prioritization of orders. Possibility of specifying e-mail addresses and mobile phone numbers where urgent results (in the form of plain text e-mails or SMS) should be sent. The Medicsis SMS module is compatible with a range of worldwide SMS gateway providers such as Clickatell, SMSified or SMSGlobal.
- Automatic calculation of needed sample types
- Encoding of requesting clinician
- Automatic generation of a laboratory order ID.
- Printing of already filled-in or blank laboratory prescription forms. The forms carry the laboratory request ID in numbers and in bar-codes for easy identification by the laboratory personnel.
- Printing of order identification labels
- Printing of sample identification labels

## Results management

Lab results can be entered into the system in 3 ways:

- Automatic integration of electronic data coming from an existing Laboratory Information Management System (LIMS). Medicsis supports several laboratory information exchange formats (Medidoc, Health-One, HL-7).
- Automatic integration of electronic data coming from laboratory analyzers (using third party DataConnect drivers).
- Manual data-entry via the Medicsis miniLIMS user-interface (accessible to the physician, the room manager or the laboratory staff). Verification of entered data against technical minimum and maximum values defined against gender and age of the patient. The miniLIMS module enables the retrieval of laboratory requests based on multiple criteria:

- Laboratory order ID: one particular order
- Admission ID or Visit ID: all orders linked to the corresponding ID
- Patient ID: all orders linked to this Patient ID
- Ordering clinician: all orders coming from the specified clinician
- Order status: lists all orders with a specified status (complete, incomplete, received)
- All of these criteria can be combined, yet provide a very flexible lab order retrieval interface. When a searched order has been retrieved, the laboratory staff can open the corresponding results record. Results can then manually be entered in the results screen. Filled-in results are immediately available in the patient's medical record after proper authorization. Every filled-in result can automatically generate a corresponding care delivery code in the patient record (for invoicing purposes).

- Laboratory results can be viewed by a single result record or with full result history from previous laboratory examinations. Every numeric analysis-result can be viewed as a graph (bar or line charts).
  - Results may be reported for a single lab order or in the form of cumulative reports.
- Finally, results can be printed in order to deliver them at the prescribing physician or the patient.
- Urgent results can be sent by e-mail or SMS using Medicsis's built-in reporting engine.
- Automatic invoicing of performed lab analysis can be enabled in the software. This functionality will generate a health service code for every performed (and configured) lab analysis that has not yet been manually invoiced in the last 24 hours.

## Order entry

A complete and comprehensive medical imaging prescription module is also available in the standard edition of Medicsis. The most important features of the module are:

- Usage of an imaging examination reference table, specifying all available imaging examinations.
- Encoding of ordering clinician
- Automatic generation of an Imaging order ID.

Printing of already filled-in or blank imaging prescription forms is available. The forms carry the imaging order ID in numbers and in bar-code for easy identification by the Medical Imaging staff.

## Results management

Medical imaging results can be entered into the system in 2 different ways:

- Automatic integration of electronic data coming from a PACS system (e.g. PACSOne or Agfa's Impax) using a generic DICOM image viewer. Medicsis supports several Medical Imaging information exchange formats (DICOM, JPEG, TIFF, PNG).

- Manual data-entry via the Medicsis miniMIMS user-interface (by the physician, the room manager or the medical imaging staff).

The mini MIMS module enables the retrieval of Medical Imaging orders based on different criteria:

- Imaging order ID: one particular order
- Admission ID or Visit ID: all orders linked to the corresponding ID
- Patient ID: all orders linked to this Patient ID
- Ordering clinician: all orders coming from the specified clinician
- Order status: lists all orders with a specific status (complete, incomplete, received)
- All of these criteria can be combined, yet provide a very flexible order retrieval interface. When a searched imaging order has been retrieved, the medical imaging staff can open the corresponding results record. The result protocol can then manually be entered into the results screen. Filled-in results are immediately available in the patient's medical record after proper authorization. Every filled-in result can automatically generate a corresponding medical act-code in the patient record (for invoicing purposes). Medical Imaging protocols can be printed in order to deliver them to the prescribing physician or to the patient. Automatic invoicing of performed medical imaging exams can be enabled in the software. This functionality will generate a health service code for every performed (and configured) exam that has not yet been manually invoiced in the last 24 hours.

## Medical record printing

Medicsis provides a complete and sophisticated module for printing of medical record content for a single patient. Selections can be made based on any combination of the following criteria:

- Types of examinations and health record documents
- Manually selected examinations and documents
- Admission ID or Visit ID
- Period of time
- Printing occurs using the built-in text-based PDF engine which guarantees full compatibility with a large majority of standard A4 or Legal format printers on the market.

## Nursing plan for patients

Based on clinician-entered drug and care prescriptions, Medicsis can generate an individual nursing plan for every (admitted) patient. Nurses can then enter the data related to their care activities in a comprehensive overview-screen in order to keep track of all nursing health services that were already provided for the encounter. Electronic nursing plans eliminate the need for establishing extensive handwritten reports when nurses change between shifts. They also provide a real-time means for monitoring the completion of all physicians' orders that were generated for a patient or a department.

## Preventive medicine

Preventive medicine procedures have been aggregated in a separate module in the Medicsis hospital information system. However, they can be consulted at any time from any other module in the software.

### Vaccination and immunization

Medicsis lets the user keep track of every patient's vaccination status. The system integrates automatic calculations of vaccination dates based on configurable vaccination schemes.

### Vaccination schemes

Any vaccination scheme can be programmed in Medicsis with little or no programming knowledge by configuring a simple XML file. Vaccination schemes can thus easily be adapted to local preferences, yet permitting clinicians at any time to make any modifications to system-generated dates. Currently, Medicsis contains WHO-referenced international schemes for the following vaccinations:

- Tetanus/diphtheria
- Hepatitis A, B, and A+B
- Yellow fever
- Typhus
- Meningococcus meningitis
- Polio
- Tick encephalitis

### Vaccination card

All patient vaccination data are comprehensively summarized on a patient vaccination card, which can be easily printed out and delivered to the patient.

### Planning and campaigns

A complete immunization planning engine has been integrated into Medicsis in order to provide an easy-to-use management tool for those who wish to organize large-scale vaccination programs.

### Risk profiles

Medicsis fully supports the definition of medical and occupational health risk profiles. These profiles aim to help clinicians in deciding which actions should be taken in particular health risk situations. Risk profiles also enhance the implementation of hospital-wide protocols for treating common clinical conditions (offering a basic implementation of clinical pathways).

## Warnings feature

Important information that should be read by any care provider that treats a particular patient (such as allergies, important communicable illnesses...) can be stored in a specific warnings module. Warnings are always shown to the user as soon as he/she opens a patient's health record. Warnings can also include limited lifetime data, specifying the beginning and end of validity.

## Data analytics, statistics, and reports

Several standard reports have been developed in Medicsis. Some of the most important reports are:

- Illness statistics for out-patients
- Illness statistics for in-patients
- Reference center reports
- Prescription per pathology
- Invoices per day
- Receipts per day
- Patient debit and credit operations
- Provisional financial status of admitted patients
- User activity and performance (KPI) reporting
- Length of stay, co-morbidity and mortality reporting per illness
- Bed occupancy reporting
- Admission and out-patient consultation reporting per room and/or physician
- Lab results statistics
- Lab reagent consumption statistics
- Health insurance coverage reports
- Analytical accounting reports based on configured cost-centers
- Out-patient and in-patient registries
- Patient origin reports
- Invoicing and cash transaction reports
- National health management information system reports
- Most of the reports can be generated in PDF, HTML, or CSV/ Excel format, enabling structured transfer to third-party applications.

### **Illness statistics for out-patients**

Lists the distribution of all main (top 10 or top 20) clinical conditions per department or per user based on ICD-10, ICPC-2 or KPGS codes.

### **Illness statistics for in-patients**

Lists the distribution of the main clinical conditions treated for in-patients

## **Illnesses and co-morbidity**

Lists of all main illnesses mortality and co-morbidity (associated clinical conditions) data.

## **Illness cost statistics**

Lists costs distribution per illness. It is presumed that at least one illness code is associated with every hospital admission (and possibly also with every out-patient visit).

## **Prescriptions per pathology**

This report lists all drug- and care prescriptions that have been registered in the database for individual clinical conditions (coded in ICD-10, ICPC-2 or KPGS).

## **User activity and performance (KPI) reporting**

Lists all activities (total numbers) per user and per department. Includes also all activities that are not necessarily linked to any financial data.

## **Length of stay reports**

Duration of admission (mean duration & standard deviation) is reported per illness code, per department and per responsible room clinician.

## **Total invoices**

Total invoice values per day, per month or per configurable period of time.

## **Money transfers**

Total money transfers per day, per cashier or front office.

## **Provisional financial status of admitted patients**

At any moment, a report can be generated in real time showing the financial status (paid deposits minus consumed care deliveries) of every admitted patient in the hospital. By clicking on the individual patient names, the user can immediately consult the detailed financial patient record.

## **Bed occupancy reports**

Lists evolution of bed availability and occupancy rate per room.



## SHAMe clinical analyzer

SHAMe is a sophisticated analytic engine for extracting statistical data from clinical data sources and sending these to a separate database, charts, or reports system. Medicsis is fully compatible with the SHAMe Clinical Analyzer.

## Global Health Barometer

Health, performance, activity and financial indicators linked to site-specific GIS information can be automatically extracted and centralized in the Global Health Barometer data warehouse (<http://www.globalhealthbarometer.net>) for remote monitoring and management. This feature is part of the Medicsis implementation and can easily be activated or deactivated by the local system administrator. The Global Health Barometer potentially provides an interesting middleware solution for generic reporting to national and international authorities.

## Medical monitoring engine

Frequently used reports and statistical extracts can be automatically generated by the integrated Medical Monitoring engine. This engine can be configured to automatically run specific reports on scheduled moments (e.g. every Sunday night) and to send them to one or more e-mail addresses within the institution (e.g. the department of statistics or senior management staff).

## Document printing

Medicsis offers an integrated module for the management of external documents. These documents are usually provided by the customer (hospital) in one of the following forms:

- Microsoft Word-documents
- PDF documents and Paper prints

Using Adobe Acrobat Professional, any of these forms will be transformed (possibly after scanning) into a PDF-form that exactly matches the layout provided by the customer. These PDF forms are stored in the Medicsis software and can be used by any authorized user of the system. Any zones on the PDF-forms, containing medical-administrative data that is available in Medicsis, will be automatically filled in. The following default documents can be generated by Medicsis:

- Legal medical expertise
- Pathology exam order
- Endoscopy protocol
- Operation theater report
- Drug prescription (bar-coded)
- Medical care prescription
- Ophthalmology prescription
- Echography order
- X-ray order
- Physiotherapy order

- Medical examination certificate
- Death certificate
- Lab analysis order
- Reference and counter-reference report
- Documents stored in Medicsis can also be explicitly assigned to specific data-entry screens. If the document module is being called from within such a screen, the default document list will only display the linked documents. Reports and documents can be configured to allow modification, completion and validation before printing.

## Pharmacy management

Medicsis provides a comprehensive module for the management of central and departmental medication and medical supply stocks. Stock operations and modifications can thereby be the result of the following actions:

### Stock inventory

With this module, initial stock levels can be fixed. The same module is used for recurring stock-corrections (e.g. yearly inventory assessment) Stock exit: removal of medication and supplies from the stock by room personnel or pharmacy staff. Every room stock exit has to be attributed to a Visit ID or an Admission ID. Stock exits can automatically add accountable care delivery codes to the patient record.

### Stock entry

Entry of medication or supplies into the local stock. This information can be entered manually or can be read electronically from corresponding SQL-Tables of a third-party pharmaceutical stock management application if available (presuming that stock exits from the central stock are stored in such an SQL-Table).

For every stock element, the following data can be stored:

- Item ID
- Item name
- Item type (medication, bandage...)
- Unit (capsule, tablet...)
- Package type (box, bottle...)
- Units per package
- Cost per unit
- Invoicing code
- Minimum level of local stock
- Maximum level of local stock
- Order level of local stock
- Preferred provider
- Batch ID and expiration date

An additional module was developed to enable printing of stock entry request forms, specifying a list of items that are requested from the central hospital stock. Items and their corresponding quantities can manually be added to the stock entry request or automatically be calculated by the software (based on data coming from 'active' medical prescriptions and pharmaceutical items' availability in the central stock). This module also permits real-time consultation of central stock product data. Stock entry requests can be printed out or transmitted electronically via SQL-tables or using structured e-mail messages.

## Stock transactions

Transfers between pharmaceutical stocks and/or external suppliers are systematically being tracked using electronic stock transaction forms. All operations related to a stock transaction form (order form, receipt form, delivery note, evacuation note...) can then be grouped together, enabling a quick way for monitoring the completion of global stock transactions:

- Which products of an order form have not been delivered?
- Which expired products have been removed for destruction?
- Which products have been removed from stock but haven't arrived at the destination stock yet?

## Stock reports

Medicis provides a number of comprehensive reports on pharmaceutical stock management and stock transactions, documenting:

- Minimum stock levels reached per product over a period of time
- Yearly product usage, including stock on hand, stock on order and expiry dates of stock batches
- Monthly product usage, including stock on hand, stock on order and expiry dates of stock batches
- Product order and receipt statistics

## Human resource management

Medicis is equipped with an advanced Human Resource Management module (HRM). The HRM module enables follow-up of all kinds of personnel data such as:

### Work contracts

- Contract ID
- Begin date
- End date
- Function/profession/role
- Title
- Functional description
- Coded regulation references

## Career

- Begin date
- End date
- Position occupied
- Department
- Grade
- Status
- Free text comment

## Education and training, diplomas and certificates

- Begin date of the training
- End date of the training
- Training institute
- Type of training
- Training level
- Title of diploma
- Date of diploma
- Internal and internationally standardized diploma codes
- Free text comments

## Skills

- Language skills (spoken, read, written)
- Driving license
- ICT knowledge
- Communication skills
- Stress management
- Free text comments

## Work schedules

- Begin date of the schedule
- End date of the schedule
- FTE
- Type of schedule (daily, weekly, monthly)
- Working time slots

## Holidays, paid annual leave, sick leave

- Begin date of leave
- End date of leave
- Duration of leave (calculated)
- Type of leave
- Date of leave request (if applicable)

- Date of leave authorization
- Authority that authorized the leave
- Code for the leave episode
- Free text comments

## Disciplinary record management

- Event date
- Title or label
- Description of the event
- Decision made
- Duration/validity of the decision
- Follow-up

## Linking with professional council databases

Medicis is pre-equipped with modules that can connect to professional council databases such as the Rwandan Medical and Dental Council or the Mali Councils for Physicians, Nurses, Pharmacists and Midwives. This way, Medicis can automatically validate on a permanent basis that health professionals employed by the health facility have been duly accredited by competent national deontological and professional bodies. In case a working permit or a professional accreditation expires, a configurable human resource manager will be automatically informed by e-mail.

## Assets management

A separate module for managing all the health facility's assets (equipment, buildings, investments) was added to Medicis. The module has been integrated with the general accounting module. For every asset, a number of data elements can be managed:

- Hierarchical and user-definable code per asset
- Management of serial numbers (when applicable)
- Quantity
- Applicable investment program (research & development, green energy, optimization of resource utilization...)
- Purchase information (price, supplier, date...)
- Depreciation method (linear, degressive, variable)
- Annuity (full year or pro rata)
- Characteristics of the investment/asset
- Ledger accounts to be used
- Residual value
- Gains and losses
- Loan and reimbursement details
- Sale data (value, client that purchased the asset)
- External documents such as pictures, operating and maintenance manuals, safety procedures etc... (using the Medicis Electronic Health Record & Document Archiving System) Medicis can print out asset identification labels including unique bar-codes which greatly facilitate later inventory control of

materialized assets. Typically, such labels are printed on permanent (non-removable) labels that remain in place for the full lifetime of the asset.

## Asset maintenance

The software also provides functionality for keeping track of all maintenance, calibration and verification procedures that must be performed on materialized assets. At any time, a report can be printed that documents the maintenance and calibration status of any asset.

## Accounting

The financial module in Medicsis provides invoicing, cash, accounts receivable and analytic accounting functionalities. Most mainstream accounting functions are being delegated to third-party accounting solutions (SAGE, SAP, OpenERP, Ciel, Venice, TomPro...). File (csv, ascii, XML) or message (RESTFul, XML) based interfaces for exchanging financial data between Medicsis and thirdparty accounting software can be provided by Stallios.

The following functions are delegated to third party accounting software:

- Registration of fiscal years, accounts, journals and transactions.
- Default normalized bookkeeping plan matching national requirements of the implementation site's country regulation.
- Purchase operations. The accounting software interfaces with the billing module in such a way that all realized sales (patient invoices and insurer- or complementary insurer invoices can easily be transferred to the accounting software using a simple point-and-click interface without any data having to be re-entered).
- Intermediate and final balance sheets, income statements
- General ledger, balances, journals and rough book modules
- Intermediate management balances
- Management of customer and supplier accounts
- Monthly or annual budget follow-up

## System security, archiving, and configuration

A series of functions of the Medicsis software cover purely technical features. Therefore, they have been brought together in this chapter.

### Security

An efficient and easy-to-manage security implementation is crucial in a production hospital information management system. Being a web-based system, all medical records are accessible to authorized users from any workstation in the hospital, regardless of the department where the records have been created. All data is stored in one encrypted database, and is managed by one central application cloud (however, the use of multiple application clouds with load balancing can be configured in case this would be necessary for performance reasons).



## User identification

Users can be identified and granted access to the Medicsis application in several ways. The most common procedure to identify and authenticate users is via a user-id/password combination. Specific password policies (periodic renewal, use of numbers, capitals etc...) can easily be enforced in Medicsis through a simple point-and-click interface. Technically, not the password but only a hash code of the provided password is being stored in the Medicsis database. This means that even a system administrator has no access to the users' login data.

Users are to be held responsible for not distributing their user-id/password combination to other users. This usually means that strict password-security policy documents have to be developed and distributed to all users. An even stronger user identification mechanism is the use of biometric data/password combinations. In that case, the user-id is replaced by a biometric (e.g. a fingerprint) ID, which has previously been registered in the user's record. Once the user has been identified by his biometric ID, the Medicsis application will ask for a password before granting access to the system. Such a mechanism prevents access to the system using stolen passwords or passwords that were obtained from other individuals.

## User profiles

Access to administrative and medical data is managed through the definition of user profiles. Such user profiles define precise access rights (read, write, delete) in every data-entry screen of the system. Well designed and elaborated user profiles will enhance the systematic application of a strict security policy throughout the institution. Consequently, every user in the system is attributed a user profile (e.g. physician, nurse, administrative clerk...), defining the user's role in the hospital information management system.

## Personal profiles

In some rare cases, users need to be granted specific access rights above those they have received in their user profile. This can be done through a specific point-and-click interface. Rights that have been attributed in this interface apply only to that single user and have no further influence on other users linked to the same user profile.

## Invalid login protection

Medicsis offers a module that temporarily blocks a login if a user tries to connect a specified number of times with a wrong password. This prevents malicious attempts to log ins to the Medicsis system using stolen log in data.

## Intrusion detection

In case a user tries a predefined number of times to enter the system with a non-existing user-id, the IP address of the workstation from where the unsuccessful attempts originate, will temporarily be refused access to the Medicsis software. This mechanism prevents malicious attacks where a hacker tries out a list of potential logins.

## User tracking

Every access by any user to any application is logged by Medicsis. This Audit Trail feature enables post-factum analysis of 'who has had access to what' in case of data access issues or privacy violations. Furthermore, for every page access that is made, performance data (download time, bandwidth usage, data volume) are stored in the system in order to enable performance monitoring by trained IT staff.

## Medicsis offline sync mode

The Medicsis Site Merger module enables the configuration of a central master of Medicsis site, with one or more peripheral slave sites. Slave sites can, at any time, synchronize their data with the central Medicsis site, where any data that was modified since the last synchronization is sent from the slave to the central master. After synchronization, slave sites have the possibility of updating their local database with data from the central server, by initiating a re-initialization process. This process then copies pre-configured selected data from the central database to the slave database, ensuring that the slave site has access to the latest version of consolidated information. A central master site and peripheral slave sites are organized in Medicsis Synchronization Groups. These groups can be permanent or temporary associations of Medicsis sites that one wishes to keep synchronized for a specific purpose:

- The use of mobile offline workstations that are used by clinicians or other users in remote locations that depend on a central master site
- The synchronization of separate Medicsis databases of different hospital sites that all belong to the same hospital group
- The synchronization between hierarchically dependent health facilities, such as a district hospital and a set of health centers
- Any specific Medicsis Synchronization Groups that would apply to this solution are described in the glossary chapter at the beginning of this document.

## Medicsis Remote server XML-extractor

This module manages the extraction from the slave site database of configured data elements that have changed after a specific date and time (default: the last previous synchronization time). The extracted data elements are then organized in a set of objects that are part of the Medicsis Domain Object Model (DOM) and exported into an XML-formatted message. This XML message can then be sent to the central site.

The following sub-tasks are handled by the Remote server XML-extractor:

- Extraction certificate management: every slave server needs a slave server manifest (or certificate) which has been generated by the central server and that allows the slave server to export data to the central site. This is a security measure.
- Define mandatory patient identification elements: this manages the data fields that can be used for

identifying unique patients (e.g. military matriculation number, national ID card number). This is to prevent multiple redundant health records being created for a patient after merging some peripheral slave data into the central master database.

- Define extractable information elements: for every PC, the slave server manifest will specify the data that is expected to be exported (administrative records, medical records, lab results, health insurance data, care deliveries, and invoices...)
- Extraction destination: extraction can be performed to a standard XML file (on a hard disk or USB memory stick) or posted to a central site URL (in case the remote slave server is connected to the central master site network)
- Generate a report on the extraction activity. This is an PDF-formatted summary of all information elements that were extracted as well as the final result status (errors or not) of the extraction process.

### **Medicis Central Site manager**

The central site manager provides interfaces for the following tasks:

- Configuration of information elements that must be merged from slave sites to the central server
- Configuration of information elements that must be distributed from the central site to the slave sites.
- Define mandatory patient identification elements: this manages the data fields that can be used for identifying unique patients (e.g. military matriculation number, national ID card number). This is to prevent multiple redundant health records being created for a patient after merging peripheral slave data into the central master database.
- Identification and management of the peripheral slave sites (location, contact persons, owner...) and wrapping the above information in a peripheral site manifests that can then be used by peripheral slave servers for running their data extraction. The manifest specifies the synchronization group(s) to which the slave server belongs.
- Management of Patient ID conflict-resolving policies: this function manages the approaches to be followed in case patient identification problems occur. Examples of approaches are the use of a waiting list of records which should be manually resolved, and the automatic creation of a new health record.

### **Medicis validator**

This module validates the data (XML-messages) that is being received by the central site from the peripheral slave servers, before injecting the information into the central database. When problems are detected with the message format or with the data in it (e.g. erroneous identifiers), then an error message is shown to the user that performs the synchronization operation.

## Medicis integrator

The XML integrator will integrate the received data into the correct tables of the central database. After the integration, a PDF summary is generated summarizing the integrated information elements.

## Information archiving

If production databases become too large, patient record information can be archived based on a number of criteria:

- Deceased patients
- Records which have shown no activity since a specific date
- Manual selection of patient records

Archiving a record means removing it from the production database and copying it to another medium (hard disk, CD, DVD). The core administrative patient data always remains in the production database:

- Name (first name, last name, alternate names)
- Date of birth
- Record ID number (other than the attributed Medicis ID, e.g. reference to a paper-based record)
- National ID number
- Language
- Gender
- Place of birth (city & country)
- Nationality
- Alternate ID (e.g. fingerprint or other biometric data)
- Comments
- Archive medium ID

A previously archived medical record can easily be restored from the archive medium identified by the Archive medium ID in the production database.

Usually, medical record archiving will not take place because of disk space shortage. Application performance is more likely to be a trigger for deciding to archive medical records.

Medicis also provides the functionality for attaching an unlimited number of scanned (electronic) documents to individual patient records, through the use of the Medicis Archiving Server solution, which is being described in detail further in this document. Also, all archived documents will be encrypted to keep the site secure.

## Archiving flow

For the purpose of linking external documents to Medicis, the following workflow logic is being used:

If we want to link one or more paper documents to Medicis, we start up Medicis identification module, enabling us to register relevant metadata about the document(s):

- Type of document (based on a structured list of document types)
- Document date (default value = active date)
- Title or label of the document
- Free text comment (optional)
- After saving the metadata, Medicsis identification module will generate a Unique Document Identifier (UDI), which the user can simply write down on the document(s). As an alternative, Medicsis identification module can also generate a bar-coded label with the UDI which can then be stuck onto the document(s).
- The labeled documents from step 2 are collected (e.g. once a day) by the document scanning department.
- At the document scanning department, the labeled/identified documents are scanned using a high-volume document scanner which stores the results in a specific directory. Therefore, UDI is systematically used as the document name. This is where manual scanning and archiving operations end.
- An automatic process will verify the scanning directory every few minutes and when new documents are detected, these will be sent to the archiving server.

The archiving server stores the received documents using the document name as a UDI, which will enable the mapping of the documents to the metadata that were previously entered in Medicsis identification module. Before this final storage & linking is committed to the database, the following validation steps are performed by Medicsis:

Firstly, the server verifies that for the UDI no existing documents have been previously stored. If such documents exist, then the storage process is halted and the scanned documents are moved to an error-file directory for later verification (this most often means that an erroneous UDI has been used). As a precaution, no automatic overwriting of existing documents can occur in Medicsis:

If a user wants to replace an existing document linked to a specific UDI with a new document, this user will first have to manually delete (detach) this existing document. If an optional bar-code recognition module has been activated in Medicsis, then the archiving server will detect the bar-coded UDI included in the scanned document and compare it to the provided document name. If the detected UDI is equal to the document name, then the document has been correctly identified by the scanning operator and the document process continues. If there is a mismatch between the UDI derived from the bar-code and the document name, then an error occurs in the document identification and the document is moved to the error-file directory for later manual processing.

All storage operations and detected identification errors are systematically logged, and the scanning operator can request a detailed report of all performed scanning & storage operations for any period of time. Based on logged errors, the scanning operator will be able to correct any mistakes that were made during previous scanning and storage attempts.

In order to avoid erroneous transcription of UDIs by the scanning operators, a check digit was integrated in the UDI (2 last figures of the UDI, similar to the algorithm used for validating bank account numbers).

As soon as the user tries to enter an erroneous number (= number with check digit mismatch), the system will show a warning preventing the faulty information from being stored in the system.

## Groupware software

Medicis comes with an advanced Collaboration Suite for next-generation messaging and collaboration. It provides administrators and their end users with innovative features that solve the challenges faced by organizations using today's legacy communications infrastructure.

## Services included

The Medicis system is a turnkey solution including all necessary services for its completion, such as:

- Preliminary functional and technical analysis
- Complementary development
- Alpha and beta testing of custom-made extensions and modules
- Implementation planning
- Test and production environment implementation
- Setup and configuration of soft and hardware components
- Recovery of existing data (where applicable)
- User and Admin staff training
- Systems integration and interfacing with third party solutions (where applicable)
- Project management and quality control
- After-care and production monitoring

## Archiving management

From a service's point of view, the following subsystems are to be seen as one single integrated solution, which will be implemented in different phases:

- Medicis Hospital Information Management System
- Medicis Document Archiving Server
- Medicis Site Merger

## Overall system Implementation

The Medicis system implementation summary has been planned in 3 consecutive phases.

Phase 1: administrative and financial implementation. In this phase, the implementation of the following products has been planned:

- Medicis IT hardware, including the IBM Z-16 supercomputer
- Medicis SaaS software solution
- Medicis - Archiving Server
- Medicis - Archiving Client
- Medicis - Archiving Server Bar-code recognition
- Medicis Site Merger - Remote server XML-extractor
- Medicis Site Merger - Central Site Manager
- Medicis Site Merger - XML Validator

- Medicsis Site Merger - XML Integrator
- Kofax VirtualReScan Professional
- Medicsis groupware
- OpenVPN server and client software components
- Medicsis data import from existing databases (MySQL)
- Fingerprint based user authentication\*
- Client's logo, document headers and other custom-made documents

Phase 2: paramedical functionality implementation. In this phase, the focus will be on implementing paramedical modules:

- Lab order entry
- Lab results management
- Medical imaging management
- Pharmacy stock management

Phase 3: clinical modules, HR, accounting and asset management implementation The last phase will focus on the integration of all clinical registration processes on the implementation site. In a parallel way, human resource management, accounting and asset management will also be deployed, including the training of the users. Therefore, the following modules will be installed and configured:

- HR module
- Accounting module
- Asset manager module
- Medical (all clinical departments of the implementation site) module

## Setup and configuration

All delivered software and hardware components will be fully installed, configured and tested according to the client's requirements. Setup and configuration will take place in collaboration with the local Admin staff whenever possible, in order to enable local technicians to take care of most of the technical issues and maintenance tasks. Software and hardware installations will systematically be followed by the production of a detailed technical report which will then be handed over to the project management team and the local Admin staff.

### Existing data import

Importing patient-related data from existing databases is part of the setup and configuration process. The client will have the responsibility of clearly describing the database architecture and the meaning of different tables and columns that contain data to be imported. Data can be imported from most of the common relational database management systems such as MySQL, Microsoft SQL Server, Oracle, Sybase Adaptive Server, PostgreSQL, Progress or Microsoft Access. Other database systems can be used as well.

Data import into Medicsis will be a one-time operation. Once the data has been imported from the existing system, no new registrations should be performed anymore on the previous information system. Also, all the imported data in the new database will be encrypted to keep the site secure.

## Training of staff

The proposed training program has been split up into 2 major parts:

- End -user training, intended for the administrative, financial, technical, paramedical and medical users on the implementation site
- Admin staff training, focused on the building of local on-site technical support and maintenance capacity

### Demonstration sessions

At the very beginning of the project, an initial demonstration session will be organized, where all relevant staff will have the opportunity to get an idea of the different modules and the functionality that can be expected from the system. At the same time, a preliminary implementation timeline will be presented in order to avoid unrealistic expectations. It is best to put in place an as broad communication as possible around the implementation project, so that no user categories feel excluded and everyone gets a change to participate right from the start.

### End-user training

End-user training should not start before a fully functional test environment is available on the implementation site. End users should have the possibility of immediately putting in practice the newly learned materials so that most of the acquired knowledge remains consolidated and integrated into their daily working routine.

Furthermore, end-user training is being organized in 2 parts:

- Initial pre-production training where users learn to work with the system in an artificial environment with test data.
- Post-implementation follow-up training where the supplier staff provide on-site on-the-job assistance to individual users while they operate the applicable modules in daily practice.

User training will largely follow the different implementation phases:

#### Phase 1: administrative and financial modules

- In the first phase, user training will mainly concentrate on administrative and financial patient management. This will be a completed Groupware training (e-mail, calendar and tasks management) and training on Medicsis.

#### Phase 2: paramedical modules

- In the second phase, training is provided on paramedical modules and for operating the Medicsis Site Merger functionality.



Phase 3: clinical, HR, accounting and asset management modules

- In the third phase, clinical data management modules, HR management, accounting and asset management training will take place.

### **Admin staff training**

Most of the Admin staff training will be organized in Phase 1, as this is where the technical elements are being put in place. Short additional Admin staff training shall however also occur early in Phase 2 and 3, in order to make the technical personnel familiar with the extra modules that were put in.

## **Interfacing with external systems**

Where required by the customer, the Medicsis system will interface with several other third-party information systems:

- Financial Accounting Module
- Human Resources Module
- Open Agenda, the Medicsis scheduling software
- Barcode readers
- Fingerprint readers, etc.

The supplier guarantees all necessary interfacing with these software packages in order to achieve a fully functional system integration.

## **Project management**

It is proposed that the project implementation of the software should be managed by:

- A project manager designated by the supplier
- A project manager designated by the client who will assure the project coordination and who will deliver to the supplier all the required information and necessary support
- A project management committee composed of the project managers and representatives of the client's medical and administrative management. This committee will formalize the closure of each project phase, decide in the case of different alternatives, and by their authority, allocate the necessary resources
- A project group composed of key users and key stakeholders. These stakeholders will be involved from the project initiation and will take the necessary actions to define the well-functioning of the information system considering the constraints and working methods in different departments.

## Responsibilities summary

### Responsibilities of the supplier

- Deliver the turnkey SaaS service, including all IT equipment and software based on the procurement.
- Install and configure all equipment and the software in order to make it a set of functional packages that can be used in a production environment at the customer's implementation site
- Deliver all necessary integration services in order to interface the software with third-party modules
- Provide all necessary project management and coordination support in order to streamline all implementation activities for the software
- Assist and help the implementation site staff in making decisions on technical and functional aspects related to the project
- Provide necessary training to the implementation site staff of the software
- Provide technical and functional support for the maintenance and upgrade of the software during the Guarantee and Maintenance periods
- Provide implementation reports as foreseen in the Project management plan

### Responsibilities of the customer

- Provide all technical and functional information necessary for successful implementation of the equipment and services requested by the customer
- Grant access to the supplier's implementation staff to the buildings and offices the equipment and services requested by the customer must be delivered
- Participate in the project management structures and tutorials, in order to have a good start
- Provide a training room with at least 10 networked computers (desktops or laptops) equipped with a video projector, or be available for a training session via a virtual-meeting service online

### Technical support and assistance

Starting after the end of the first user training and for the duration of the contract, Stallios will provide 24/7 technical assistance to the customer.

## About Stallios

Stallios is a leading technology company with the mission of creating a new generation of futuristic and innovative super-products capable of bringing more value to our lives, and solving some problems that we face on our beautiful planet. By offering those innovative super-products to the world, we hope to enhance the quality of life of everyone online, at home, at the office, and outdoors. Welcome to Stallios!

