UltraGenda®

Hospital-wide scheduling and appointment bookings in the Internet age

SUMMARY

As a result of the profound changes taking place in medicine, healthcare delivery and society at large, resource planning in hospitals becomes an ever more critical and complex issue. An issue with which traditional Hospital Information Systems cannot cope.

This article aims to show that the requirements for the appointment scheduling function have risen to such complexity that they can only be addressed by a dedicated, best in class application. The nature of the application and its integration into the HIS are discussed, together with the unprecedented opportunities for change. These include, inter alia, the use of the Internet for the online booking of appointments.

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PART I: THE CHANGING WORLD

How appointment and planning functions are affected by evolutions in medecine, healthcare delivery and society

Hospitals are complex service organisations

Hospitals' planning and scheduling requirements have changed dramatically. Whereas in the past diagnosis and treatment were based on individual knowledge and skills, they have nowadays increasingly become a *multidisciplinary* affair – leading to substantially more complexity in the scheduling process. Also, in less than twenty years the average length of stay has halved, and patient throughput has therefore doubled[1]. The hospital organization has become far more complex; and resources are now so expensive that their full utilization is a must. Competition and economies of scale achieved by mergers are the order of the day and lead to sub-specialisation, demand for improved customer services, and cross-hospital planning needs.

In short, in less than a quarter of a century hospitals have evolved into extremely complex service organisations in which speed, efficiency and service are the main priorities, and planning and patient logistics play a critical role. A return to the old days is unthinkable.

The Internet society

The changes that have occurred in society are no less irreversible. In less than ten years, "passive" hospital patients have evolved into self-confident and highly demanding consumers.

This evolution has had its effect on the perception of the appointment bookings process. Patients find it increasingly difficult to put up with the inefficiency and frustration associated with telephone and paper, and expect speed, efficiency and service. As day after day the Internet encroaches further into their lives, online appointments become an almost 'natural' requirement[1].

New requirements for appointment scheduling

The changes in their own organization and in society compel hospitals to review their approach to scheduling.

The traditional appointment booking process, once a necessary evil, has evolved into the cornerstone of the hospital production process, and a critical factor in the so much needed revolution in efficiency and service. And as it directly triggers other complex logistics processes, it becomes the 'primary planning', the foundation layer for Enterprise Resource Planning (ERP).

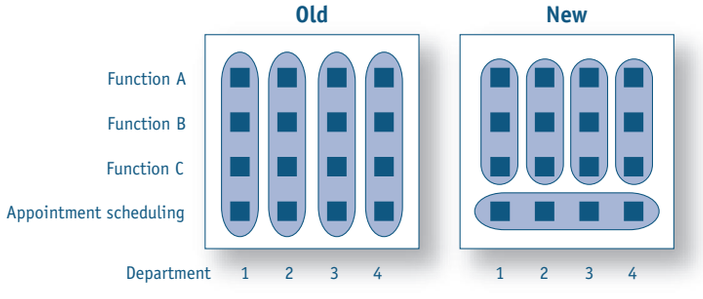
[1] This expectation is not limited to patients wanting to book appointments via the Internet. All actors involved (even doctors!) increasingly expect call centres, PDAs, sms and email to play a greater role.

Not only is the *role* of appointment scheduling changing, its *nature* is as well. Today, many departments or clinics have their own scheduling system. This duplication is a drag on the overall efficiency. Vertical scheduling leads to waste of time and to other inefficiencies. Take a routine operation: booking the operating room, the surgeon, the anaesthetist, and other staff and resources as required, but also reservations for a pre-operative consultation with the anaesthetist and for medical imaging[2]. Anyone *not* involved in healthcare would regard the scheduling of these resources in different systems as truly outrageous, yet in healthcare it is the normal state of affairs. The drive to greater efficiency implies 'tilting' the scheduling function from the vertical to the horizontal. Resource planning is best done via one single common layer operating throughout the hospital.

The familiar figure of the booking assistant being the only one authorized to access one or more diaries will also come under fire. In the new economy every employee has direct access to relevant information and/or functions via a sophisticated mechanism of access rights.

Take the switchboard operator. Even when she might not be the right person to actually *book* an appointment, why is it that she can't help out a patient who has forgotten the date and time of his next visit? Today, *distribution*[3] is essential: making an application widely available (preferably via a browser) and allowing users to access certain information and/or functions depending on their own role and rights. In the case of the switchboard operator, these rights might be restricted to seeing the patient's future appointments.

And yet more is needed. Appointment scheduling should trigger other routine planning processes. Processes that are critically important but never figure in a traditional HIS. For example bed planning or patient transport.



Modern scheduling systems operate hospital-wide, allowing resources from various departments to be combined for a single appointment or multiple appointments. This implies that the appointment function will shift from vertical (departmental) to horizontal. However, this shift does not detract from the specific features, rules, or confidentiality of the appointments function in each department. That is why access regulation is much more sophisticated in a system that operates hospital-wide than in a system limited to one department.

[2] Order entry systems contribute to quality and efficiency in the *demand* process but leave the *scheduling* challenge unaffected.

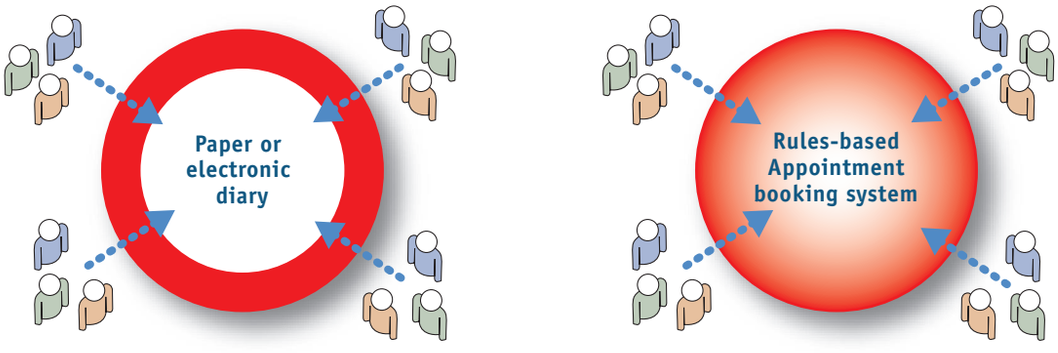
[3] The debate on whether appointments should be handled centrally or locally is outdated. Some types of appointments are best handled centrally, while for others this is not at all appropriate.

However, the greatest challenge facing the scheduling function lies in coping with the ever-increasing complexity of what goes on within the hospital walls. Appointments are subject to thousands of rules that are not only highly individual and complex but also liable to frequent change. This is true for straightforward appointments, and all the more so for complex reservations. The developments illustrated above have led to a dramatic increase in the number and complexity of these rules. As a result, appointment booking can now only be undertaken by real experts – *those who know the rules*. This not only makes the system highly vulnerable (because it depends on individuals), it also heralds a time when even trained secretaries will no longer be able to book complex series of appointments, simply because the number and complexity of appointment rules have grown too high[4]. Therefore, what is needed is a rules-based, intelligent appointment scheduling system that is smooth and flexible, capable of storing a variety of specific, complex and rapidly changing rules. In other words: an application that can remember and apply the wisdom now in the heads of booking staff.

As if this were not enough, patients nowadays expect to be able to book their appointments over the Internet. This expectation raises requirements of quite a different nature: functional, but especially in terms of security and 'protection of rules'. Internet appointments are a huge challenge. If patients are to be offered the choice between different hospitals (for example, wait 10 days and travel 40 km or wait five days and travel 100 km), the challenge takes gigantic proportions.

Time for change

The sharp contrast in hospitals between excellence (in the form of knowledge, skills and equipment) on the one hand and laborious processes such as appointment scheduling[5] on the other becomes embarrassing. But turning the tide is not easy, and hospitals continue to lag behind other sectors of the economy in terms of productivity gains and modern service provision. A radical new approach is required.



In the conventional approach, schedules are protected against 'intruders' by a protective layer: a secretary or booking assistant. She knows the rules that apply and sets up appointments according to those rules. When she is unavailable, the system collapses. The conventional appointments system is a registration system.

In the modern approach, protection lies within the solution rather than around it. The rules are stored in the application, which therefore becomes 'intelligent'. The question of who 'talks to' the solution is less relevant. The modern appointments system is a rules-based scheduling system.

[4] This is already the case in nuclear medicine for example.

[5] But also other patient logistics processes such as bed planning and patient transport.

This approach rests on understanding that efficient and customer-friendly appointment scheduling requires a generic, intelligent and highly sophisticated IT system; undoubtedly the most complex of all functions within the HIS. This system must not only be extremely parameterable[6] (because appointment rules cannot be standardised), but must also meet fast-changing and very high requirements in terms of functionality and accessibility – both internal and from outside.

Developing and updating a system of this kind is not the task of an HIS supplier, irrespective of size or competence. Modern hospital information systems contain dozens of modules which need adapting constantly to specific national (and sometimes customer) requirements. That in itself is a huge task. Developing a groundbreaking, generic and rules-based appointment scheduling application – without doubt the most complex of all HIS components – cannot be combined with the everyday work of HIS suppliers[7]. This is a job for a niche player.

[6] By which is meant: 'flexible in how it can be configured'.

[7] This of course does not mean that HIS suppliers cannot offer niche products.

PART II: HOSPITAL-WIDE SCHEDULING

The 'best in class' application as a component of a 'total' Hospital Information System

The 'traditional' relationship between the appointment scheduling function and the rest of the HIS

In terms of architecture a HIS stands between two extremes. On the one hand monolithic systems with bundled, complex application software, a single database and one consistent user interface. On the other hand, an integrated set of different sub-systems with clearly differentiated application software, separate databases and discrete user interfaces. In practice, hybrid systems are common: monolithic systems with links to a few specific sub-systems, or solutions in which multiple sub-systems share a common data structure and/or user interface. Hence, behind the 'shell' of a so-called 'total or *holistic* solution' is often a collection of sub-systems with either independent or shared data storage and/or more or less consistent user interfaces.

Suppliers of true monolithic systems shudder at the thought of multiple user interfaces, and rightly so. The different 'look and feels' of the varying sub-systems are a nuisance. Unfortunately, the user interfaces of true monolithic systems not exactly reflect ergonomics best practice. They combine dozens of functions in a tangle of menus, buttons and pop-up screens. Such is not the environment that a scheduling system requires.

Also the concerns about redundant data storage are understandable, although it should be remembered that many 'total solutions' contain a great deal of invisible redundancy[8] behind the visible 'shell'. Only true monolithic systems – and these form a very small minority of all HIS systems on the market – can claim absolute data consistency. But the price to pay in the form of an almost total lack of evolution is just unacceptable.

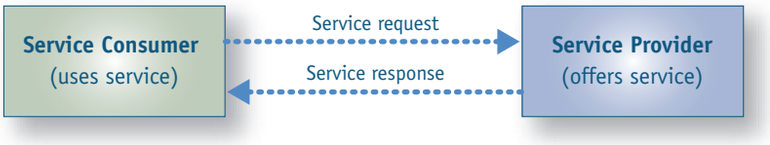
The 'best in class' approach

The colossal challenges facing resource scheduling can only be met if the underlying scheduling software is truly 'best-in-class'. Ideally, the application interacts with the rest of the HIS in the framework of a service-oriented architecture (SOA).

In this approach the scheduling application becomes a service provider integrated with other components of the HIS or with the HIS at large. It deals with a clear set of scheduling-specific functions and manages to this end the appointment-specific parameters, access rights and business rules. Ideally, when implemented within the framework of an SOA, it receives a request, proceeds with a transaction, and returns a result. The 'best-in-class' application can thus evolve freely, both in terms of functionality and platform, or can even be removed and replaced at any time without this impacting on the overall HIS[9].

[8] After all, 'one single database' is not a synonym of 'no redundancy'! The database is often 'internally' synchronised.

[9] In the case of monolithic systems new releases for the sake of improvements in the appointments component are very unlikely. The data model underlying such applications is so complicated and convoluted that suppliers are (rightly) reluctant to add new functions for fear of undermining the entire system.



Service Oriented Architecture (SOA) is widely accepted as the basis for the next generation of software. The core principle of SOA is that the functionality of the total system is delivered via various so-called 'services'. These services are autonomous, independent and replaceable and interoperate via open standards. The presentation layer, the business layer and the data layer are strictly separated. Data belonging to a particular service can only be exchanged via a standardised messaging system. The benefits of SOA include maintainability, transparency, and reusability. The integration (one-way or two-way traffic) is unambiguous and unaffected by database changes, which is a sharp contrast with the problems related to integration vulnerability as found in current systems.

This means that as far as the core HIS is concerned, options are greater, risks smaller and the useful life of the system is longer.

The service provider is 'intelligent' in the sense that it can map actual working practices, thus enabling even the most complex series of cross-departmental appointments to be scheduled efficiently taking account of all the underlying booking rules. But it must be capable of more: its intelligence must allow it to react appropriately to its 'interlocutor' (i.e. a particular user or service consumer). For example, a switchboard operator would *not* be able to access a *schedule* but would only be able to see (some or all of) a patient's *future appointments*. And a search engine would not display *all* the free slots in one or more schedules, but only a predetermined *percentage*[10]. Appointment-related workflow issues also belong to the domain of the service provider, e.g. test B has to be carried out at least 24 hours and at most 3 days after test A, and only if certain conditions have been fulfilled. In short, the appointment provider is constantly 'tuned' to the specific rules of one or more resources (persons or machines). And no single user can consult information or use functions without the explicit consent of the resource(s) affected.

A modern service provider for scheduling needs to meet current consumer/patient expectations. Only truly web native applications can do so. 'Born on the web' systems, i.e. systems conceived and designed with the Internet in mind'[11], are quite different from 'web-enabled' applications - traditional client-server applications with a web front end offering limited functionalities. As they are installed at server-side only (with the client PC just using a browser), they offer considerable benefits in terms of scalability, installation, maintenance, accessibility and security[12], which explain their extremely low TCO (total cost of ownership) and evolubility[13]. Through their service layer, web-native applications lend themselves perfectly to integration, allowing new devices (mobile phones, PDAs, digital voice, digital TV, etc.) to play an almost natural role in the booking process.

Alleged drawbacks

The user interface

No single HIS has a consistent user interface for all functions, including appointments scheduling. This should not come as a surprise. Scheduling is so rich and complex a function that it requires a specific user interface – discrete, consistent and well-designed.

[10] And not - as is often the case at present - predetermined *slots*.

[11] This goes much further than just the architecture. The *very concept* of the application is the issue here.

[12] Web-native applications are ideally delivered via SaaS (Software as a Service) or ASP (Application Service Provider) modules, enabling hospitals to use the application via the Internet and to be relieved of all IT tasks.

[13] By which is meant: 'the ability to stay up to date'.

A web interface is ideal: it is intuitive and universally available, and imposes no particular requirements as to the client desktop. But not all users need this 'rich' scheduling user interface. As the relevant information can be made available directly in the HIS via web services, users who only need access to a limited range of functions (such as doctors wanting to see their schedule, or switchboard operators wanting to see future appointments of a patient) can stay with their usual user interface.

Data duplication and redundancy

A scheduling system needs access to data stored in so-called master files (such as patients, doctors, referring practitioners and users). The HIS is the owner of this data and exchanges it in real time with the scheduling application. Although this requires no redundant data entry, it must be admitted that it does entail redundant data storage[14]. However, the volume of this data is very low, compared to the complex set of appointment parameters[15] that is owned by the scheduling application and not redundantly stored. 'Appointment events' for their part can be called up in real time by the HIS at any time via the service layer, and need therefore not to be redundantly stored either.

Finally, hospital-wide management reporting can easily be achieved by means of OLAP queries on a data warehouse fed by the scheduling system[16]. Here again redundant data storage does not apply.

[14] But to the extent that web services are used to integrate both applications, there is not even redundant data storage!

[15] Appointment types are a good example of this.

[16] And by other sub-systems or the HIS as a whole.

Integrating the 'best in class' application

The need for integration

A generic, rules-based, parameterable and web-based appointment service provider is not an island. Connectivity and integration are crucial:

- *Appointments are triggered by other processes,* such as order entry systems, clinical pathways or workflow applications[17].
- *Appointments trigger other processes.* For example, under certain conditions a certain 'appointment event', such as the creation, cancellation or closure of an appointment, can trigger a patient transport system or a supply chain system.
- *Appointment-related information must be available in other systems.* For example, if a patient does not attend his appointment, this should ideally be recorded in his or her electronic patient record (EPR); and a radiology appointment for an admitted patient must be available in the nursing record.
- *The appointment application must be easily 'accessible' from other environments.* Users logged into other parts of the HIS, such as the EPR, RIS or clinical workstation must be able to access the scheduling application easily without having to enter any other information – not even 'just' a password or a patient's name.

Three methods are used to achieve this goal:

- *Asynchronous integration.* Being a very 'traditional' form of integration, its main benefit is that messages are standardised (HL7); the disadvantage is that unsolicited information required only for a short time (if at all) is sent continuously and stored redundantly, thus creating substantial overhead. Therefore, asynchronous messaging is a good option only for data that has to be stored in the receiving system for future processing.
- *Synchronous integration using XML web services.* This technique is particularly suitable when data need to be made available to the consuming system if and when needed. It results in a highly 'efficient' integration: the data is always accurate and up-to-date, and neither redundant data storage nor superfluous continuous messaging take place. In addition, web services are completely platform-independent. The drawback of web services is that the technology is currently only being discovered by most hospital software suppliers.
- *Visual integration* (preferably based on the CCOW[18] recommendations), in which users switch smoothly from one system to another while retaining the context (e.g. user context, patient context and order context). Despite the fact that in this case both systems remain autonomous (no back-end data exchange occurs), the end user does not have to cope with the disadvantages of separate systems (duplication of logging on, patient identification, etc.).

[17] So that the system doesn't just schedule 'the right appointment', but also 'the right appointment at the right time'.

[18] Clinical Context Objects Workgroup, see www.hl7.org (Clinical Context Management Specification).

In practice

A summary of the most common integrations between the appointments system and other parts of the HIS is given below.

If properly documented, each of these integration tasks will not take more than a few days to complete in practice. Asynchronous messaging is often facilitated by an interface engine, allowing each party to keep its own 'version' of the message. The most efficient form of integration is via XML web services, offering all the benefits of service-oriented architecture while avoiding redundancy.

	Asynchronous integration	Visual integration	Web services	
Patient and admission data	•			
			•	The scheduling application calls up a web service usually in the context of an eMPI (enterprise-wide master patient index)
Synchronisation of common files (doctors, referring practitioners, appointment types, etc.)	•			
Electronic medical record Electronic nursing record	•			For example, to note in the EPR that the patient did not attend the appointment.
		•		
			•	The EPR calls up a web service (e.g. so that appointments for particular doctors or patients are automatically displayed in the EPR) or vice versa (to show critical medical information in the patient tab of the scheduling system)
Order management systems	•			To support order entries and return the appointment confirmation
		•		Order remains in CPOE system; context switch is started when order picked up for scheduling. Confirmation returns to CPOE.
Coding systems, tarification and billing	•			To synchronise coding tables so that a coding can be entered immediately in the scheduling application once the appointment has been made
		•		When the appointment has been made, the coding application is launched and context is transmitted
			•	The tarification system calls up a web service to request appointments closed in the scheduling system
Departemental systems (imaging, operating theatre, etc.)	•			To feed worklists in the relevant AND (optional) update the scheduling system in the light of events (e.g. operation status)
			•	The relevant system calls up a web service to request the appointment list
Users	•			
			•	The scheduling application calls up a web service or LDAP query to authenticate the user

Integration with less common components of the HIS

As pointed out above, an appointments system also interacts with logistics processes that are hardly ever supported by the HIS. Examples of these include bed planning and patient transport.

Beds are just as critical a resource as doctors and operating room staff. Ideally, when booking an appointment (for surgery, for instance) a check should be made to see whether a suitable bed (suitable for the patient, dates, and type of surgery) is available. In other words: the 'bed' resource needs to be part of the search and booking process.

During the appointment booking process, any transport needs will be registered and passed on to the patient transport system, along with the time and place of the appointment. Alternatively, when the appointment is closed, or when certain stage markers have been reached, the transport system can be automatically advised.

Since these two functions are not supported in the traditional HIS, they are best provided by a 'best-in-class' application in a service oriented architecture. Hence, integration will be achieved via web services.

Conclusion

Integrating a best-in-class appointment scheduling application with the rest of the HIS does not need to be a tortuous process but can be achieved quickly and easily. This approach will enrich the functions of the HIS while also making it more responsive to changing circumstances and customer requirements: the best of both worlds.

This can only happen if the principles set out above are respected, if the integration follows standards and guidelines (such as the IHE guidelines), and if the process is fully documented.

Web services offer unprecedented opportunities for efficient, platform-independent integration and are therefore the number one choice.

A rules-based, web-native and hospital-wide scheduling system enables hospitals to achieve huge efficiency gains in that it helps to cut cost, increase resource utilization, boost staff morale and –flexibility and reduce DNA rates. It also contributes to quality and traceability.

In the area of service improvement the benefits are equally important. Hospitals can choose to offer a 24/7 appointment service, centralize or decentralize appointment scheduling, or even enable cross-departmental bookings. Patient's preferences can be taken into account when searching for free slots, relevant instructions and information included in confirmation letters or e-mails, and patients be reminded about their upcoming appointment via e-mail.

And if all this were not enough, a best in class system for scheduling opens the door to the revolution of online bookings. This aspect is covered in Part III of this paper.

UltraGenda Pro for hospital-wide scheduling

Best in class

UltraGenda Pro is the fruit of the reflections outlined above and of some 70 man-years of research and development. The solution was first introduced late 2000 and has continuously evolved since then. With a customer base of more than 100 leading hospitals[19] across Europe, UltraGenda Pro is regarded as the scheduling system 'par excellence'.

Generic

UltraGenda Pro is a generic 'primary planning system' which schedules and manages all individual resources needed for tests, interventions and consultations. As a result, the system lends itself to any department or clinic, including imaging and operating theatres, or indeed to any hospital irrespective of type, size or location. UltraGenda Pro does not follow a hospital-specific or country-specific approach. Instead, it is highly parameterable so that it can cope with the widest possible range of requirements.

Rules-based

UltraGenda Pro is not an 'appointment registration system' but an 'appointment scheduling system'. Appointments are subject to thousands of rules and regulations that are specific to a particular hospital, department or resource and are also liable to change at any time.

The solution can handle this complexity with ease thanks to a parameterisation hierarchy that works at three levels (organisation, department, and individual/resource). This means that existing working practices can be mapped while leaving room for business process reengineering.

Functionally rich

The days when scheduling consisted of recording a 15-minute appointment in a diary are over. The requirements are extremely varied: fixed and flexible appointment slots; one or more patients per slot; booking multiple resources for one appointment (which may or may not be needed at the same time and for the same length of time); looking for free slots across departments; automatic rescheduling if a doctor or a facility is unavailable; scheduling order sets with predefined intervals between appointments; offering free slots according to particular needs or priorities; achieving optimum (theatre) occupancy; serial appointments, and much, much more.

UltraGenda Pro supports all these functions and so deserves the title of 'hospital-wide primary planning system'.

[19] The majority of customers are large (often teaching) hospitals with more than 600 beds.

100% web

The solution is installed at server-side only, and client PCs access the application via their web browser.

- This means that new versions can regularly and easily be made available;
- all clients use the same generic version;
- support is much more straightforward (because the hospital server is accessible via VPN);
- the solution is ideal for ASP or SaaS delivery, relieving the customer of all IT concerns;
- first-line support is virtually non existent;
- the total cost of ownership is minimal (IT staff no longer need to oversee client PCs).

The intuitive web interface contributes to user friendliness (the average end user training time is less than 30 minutes), and the service layer provides for seamless integration with PDAs, SMS, e-mail and reminder services.

Integration

UltraGenda Pro has been integrated with dozens of HIS systems or HIS components. These include small and large systems, systems operated by global players and by smaller or local suppliers, monolithic and integrated solutions. Well over 100 hospitals all over Europe have integrated with various functions, such as:

- patient administration: 100%
- EPR: 40%
- work flow and order entry: 15%
- coding, billing: 25%
- departmental systems: 40%

As far as departmental systems are concerned, UltraGenda Pro takes charge of scheduling all appointments and passes them on to the relevant RIS (or RIS/PACS) or OR management solution[20] for further processing.

All the integration mechanisms supported by UltraGenda are based on international standards and guidelines such as HL7 and EHI. Most of the functionality of the solution is exposed as web services, making UltraGenda Pro a key component of a SOA-based HIS. And as all integration procedures are generic and fully documented, integration projects are usually completed within weeks.

[20] UltraGenda Pro is integrated with the departmental solutions of world players such as Agfa, Kodak and GE.

PART III: ONLINE APPOINTMENTS

The challenge of internet appointments

Why online bookings don't take off

No business process has seen less change over the last fifty years than appointment scheduling in healthcare. Pen, paper and telephone are still the business tools 'par excellence'. IT support – when at all – is primitive in every sense of the word: rigid, falling short of real needs and inaccessible to the principal actor, namely the patient. With hospital environments becoming everyday more complex and patients used to the comfort of the Internet the situation becomes more acute and embarrassing by the day.

In the previous paragraphs, we have argued that only a best in class system within a Service Oriented Architecture (SOA) is able to cope with the scheduling needs of a modern hospital and we have discussed its role and place within the overall HIS. In the next paragraphs, we focus on a related subject that is likely to become a hype in the years to come: *online bookings*.

Why is it that at times when citizens can conduct almost any transaction via the Internet, routine referrals and bookings remain a nightmare? After all, the scale of the issue is impressive – the annual number of hospital appointments in Europe and North America must be in the order of 8 billion. Patients holding up the transformation? Most unlikely. And why would security be more stringent for hospital referrals or bookings than for online financial transactions of which millions are conducted every day?

If it's neither the scale of the issue, the readiness for change or the technology, why then has Internet not been able to play a role in the apparently simple referral and booking process? Why have the attempts undertaken to book appointments online remained largely unsuccessful? And will the referral and appointment booking process ever enter the Internet age in the first place?

The answer to these questions can be learned from recent history. At the beginning of this century, the Internet bubble burst. The reason for the crash – as appeared later – did not lie with the new technology, but rather with the old one. Only when legacy back-end applications were replaced by modern systems, able to cope with the requirements of the new business concepts did online business transactions take off -and how! *It's no different with bookings.*

Rules, rules, rules

As has been argued before, the problem with appointment scheduling is that the process itself is simple in appearance only. Not only is it infinitely more complex than the average business transaction, it is driven by literally thousands of rules, which change almost by the day. Control of these rules is a prime concern for every schedule-owner (generally physicians). As a result only the closest booking assistants and secretaries deserve their trust in matters of bookings. And rightly so. Putting the average booking system in the hands of a patient – even via a magical portal – is just as smart as handing the keys of the cockpit to the passenger.

Neither the average scheduling system nor the fancy online booking tool provides what physicians are looking for, i.e. *control*. It explains why both small- and large-scale projects in this area fail.

If e-bookings are to succeed – and they will – then a new concept is needed. At the heart of it is an enterprise-wide scheduling system that through its intelligence resembles more an ERP (Enterprise Resource Planning) than a traditional scheduling system. That system is called *UltraGenda Pro*, and the overall concept *Appointment Storm*.

UltraGenda Pro: the centrepiece of online bookings

In the previous paragraphs, UltraGenda Pro was primarily positioned as the primary planning layer for the hospital and also its benefits were evaluated mainly from the viewpoint of the 'hospital enterprise'.

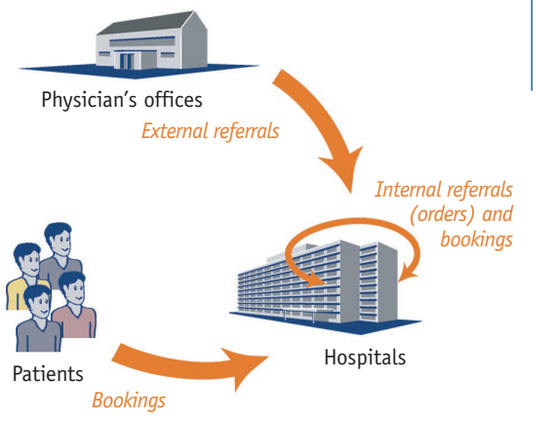
The next paragraphs go well beyond this discussion. They focus on the role of UltraGenda Pro as the centrepiece of Appointment Storm, a groundbreaking concept for online bookings at the level of the healthcare community.

Online referrals and bookings

Referrals and bookings: current business flows

The main actors in the referral and booking process are the hospitals themselves, patients and referring healthcare professionals. At the level of the community at large other actors such as call centres, payer's offices, homecare workers, elderly homes, etc. come into play.

The interaction between the main actors takes the following forms:



Patients make appointments with the hospital (generally by phone) for referred appointments (e.g. family doctor refers patient to a hospital doctor for further advice) or for non-referred appointments (e.g. follow-up treatment in diabetes). Family doctors or other healthcare professionals either simply refer (the rule), or refer and book (the exception).

In each of the cases the current process is archaic and inefficient. This is reflected in:

- the *quality* of the referral: information is often irrelevant or insufficient, leading to further time-consuming dialogues or downright wrong authorizations (e.g. patient is not apt to undergo a certain exam such as CT);
- the *speed* of the process: often, referrals are still made via letter;
- the *bureaucracy* involved: letters are written, sent, registered, opened, checked, verified, replied to, scanned, archived, lost, etc. Patients need to call, spell their names, provide details and when finally an appointment is made, the confirmation is often done ... per letter!

The above inefficiencies are mainly the result of these processes relying on so-called 'middlemen', the main role of whom is 'to apply rules'. Hence, in the necessary transformation of the system *rules control* is vital.

Requirements for online bookings

The referral and booking process is composed of four generic sub-processes. For some of these, the requirements in terms of rules control are different for online booking systems vs. traditional systems.

WHO ?	Identify patient
WHAT ?	Communicate - authorize
WHEN ?	Allocate resources - plan
CONFIRM	Inform - instruct - remind

Identify patient

Although online booking systems pose additional requirements such as identification and authentication, the basic issues are not much different from those in current systems:

- Where resides the Master Patient Index (MPI) and what is its quality ?
- Can patients that are not on the MPI get a referral or a booking, and if so, how is the subsequent identification process managed?

Authorize

Traditionally

The simplest form of authorization is the booking assistant registering an appointment via the phone without further questions. However, the authorization process can sometimes be much more complex and structured. In that case, it is commonly known as the referral. Referral and referral authorization are manual processes, designed to protect the quality of the appointment, i.e. to make sure that the patient is referred for the 'right' procedure or visit.

Online scenario

This is an essentially rules-based process (referral rules tend to vary among hospitals, clinics, doctors as well as over time!) that requires an online, interactive dialogue on the basis of so-called referral protocols so as to give the providing department or clinician the assurance that all its requirements have been fully met.

Allocate resources

Traditionally

Resource allocation, commonly called the scheduling process, is the most complex of the four sub processes. Traditionally, it is done in rather rudimentary IT systems, controlled by a human layer – the booking assistant. Resource allocation falls apart in:

- search for free 'appropriate' slots, whereby the term 'appropriate' is defined by the procedure or visit including its urgency as well as many other parameters;
- select one of the offered slots and book.

Online scenario

As has been argued in the previous paragraphs the allocation process is so immensely complex and rules-based that it can in practice only be handled by a dedicated application such as UltraGenda Pro.

However, there is no question to grant the user direct access to the appointment scheduling system. Rather is it an 'intermediate' (or portal) application that conducts that dialogue. Both the scheduling system and the portal application have their own sets of rules, so as to make sure that a user will only see the information or conduct the transaction for which he/she has been authorized.

Confirm, inform, instruct, remind

Traditionally

Confirmation as well as relevant information and instructions are often provided by phone. This increases the chances of no show-up appointments. Confirmations per letter for their part are slow and expensive. And legacy systems do not enable confirmation letters to include specific instructions due to insufficient 'granularity' in the parameterization process.

Online scenario

Relevant information and instructions are produced online, which improves service and boosts efficiency. They can be consulted at any time. Reminders per sms or e-mail, an efficient tool to reduce DNA rates are triggered automatically.

The role of the portal

Online bookings can only be successful if all of the above sub processes are entirely under control. However, the 3rd process (allocate resources) is so complex that only a state-of-the-art, rules-based and web-native scheduling system can cope. This explains why online booking initiatives based on legacy scheduling systems invariably fail to deliver, even when 'mechanically' they may well work. UltraGenda Pro is the only system, sufficiently sophisticated to address these complex needs and hence make online bookings a reality.

A web-native, rules-based, enterprise-wide system such as UltraGenda Pro may be a prerequisite for online bookings to succeed, but it is by no means the only condition. Sub processes 1, 2 and 4 – and their integration with the scheduling system – need to be managed as well. A difficult task that encompasses such diverse functions as:

- enabling the user (referring professional and/or patient) to identify and authenticate, and to calibrate the access to information and functions according to his/her specific access rights;
- enabling the referring healthcare professional to look up and select a patient from a patient index;
- enabling hospitals, their departments and doctors, to design interactive referral forms for each of the appointment types, subject to online referral;
- enabling referring physicians to select and complete one or more interactive referral protocols;
- interacting with the underlying scheduling system in order to store the referral and enable its conversion into an appointment at a later stage;
- displaying all or part of the available slots that meet the 'request' criteria;
- enabling the patient to view the status of booked appointments, and/or to cancel or reschedule booked appointments and obtain information and instructions at all times;
- reminding the patient about his upcoming appointments.

These and other functions are exposed by a portal application, which we call UG Broka (from 'broker').

UltraGenda's Appointment Storm: groundbreaking reality

UltraGenda's approach toward e-referrals and e-bookings consists of two separate platforms, each having their specific function. They interact seamlessly with one another via XML Web Services in the framework of a service-oriented architecture.

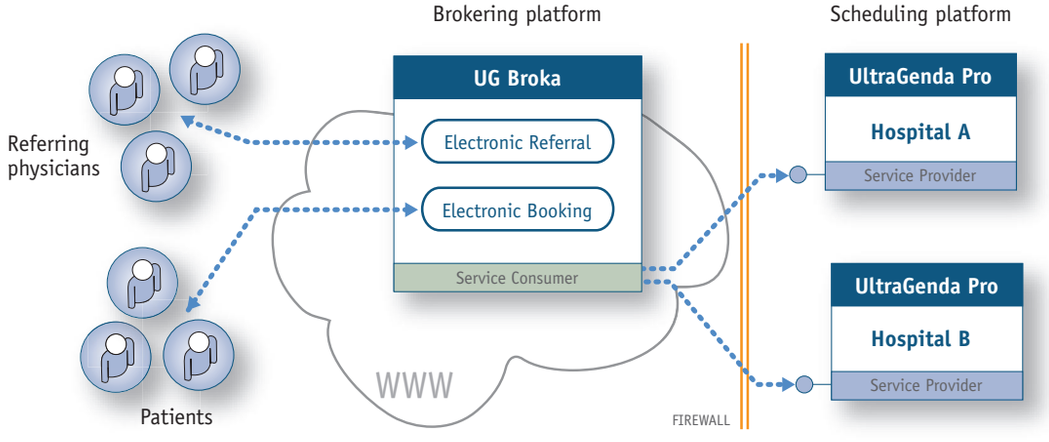
- the *scheduling* platform UltraGenda Pro;
- the *brokering* platform or portal for the referring professional and the patient, driven by our portal application UG Broka.

The common characteristic of both UltraGenda Pro and UG Broka is their extreme parameter ability so as to ensure the total and uncompromising protection of the rules of the major actors, i.e. the physicians. The scheduling rules are managed in UltraGenda Pro.

UG Broka for its part is a portal application, i.e. software that is 'hooked in' a website or portal (of a hospital, an HMO or hospital group, a region or even a nation). The access rights are always managed in UG Broka but the actual identification and authentication process normally does not take place in UG Broka (although the application does provide out-of-the box user/password authentication). It generally takes place in the portal itself via third party technology such as tokens, certificates, electronic identity cards, etc.

UG Broka offers functions in three areas:

- Administration of referral paths (or referral protocols)
- Portal for referring physicians
- Portal for patients



Patient and referring physicians never have direct access to UltraGenda Pro but use UG Broka which interacts in real time with the underlying scheduling application via XML web services.

Examples of rules managed in the scheduling application	Examples of rules managed in the portal application
• When are resources available? • What appointment types are available? • Which resources are needed for each appointment type? • Who is entitled to see information? What information? • Who is entitled to book? Book what? With which resources? • Do specific conditions need to be fulfilled to allow a specific booking? • What is the 'reach range' for a specific appointment type? • What percentage of a resource capacity is offered to individual users? • Are there appointment incompatibilities? • Definition of serial appointments: sequence, time intervals. • ...	• What referral protocols are offered? Who has access to what protocol(s)? • How is each protocol structured? To what appointment type does it lead, if at all? • What are the instructions and information provided with each specific referral authorization? • Which referrals can be converted online? If so, how many free slots are offered? • Do other specific conditions need to be fulfilled to allow the booking to take place? • What appointment types can be booked directly by the patient (without previous referral)? • For each of these, which patients have access? • How 'soon' can the patient book? How many bookings can a patient make? • Can an appointment be cancelled online? If yes, when by the latest? • ...

Protocol design

This function enables the hospital departments to define the referral criteria via a generic and interactive 'triage' tool, i.e. to specify the rules currently applied by the department's physicians to evaluate a referral letter. Rules can range from very simple to complex. Once completed – and provided the criteria are met – a protocol leads to an authorization for referral. Referral protocols can be defined per department or service line or per pathology. They are protected by access rights.

Referring physician's portal

The portal for the referring physician essentially provides the following sub-functions (each of them entirely controlled via access rights):

- select a patient from the master patient index or create a new patient (which will NOT be passed on to the master patient index);
- select one or more referral protocols and complete;
- store the authorized referral in the scheduling application;
- obtain relevant instructions and information as well as a booking code which enables the conversion of the referral into an appointment.

Patient portal

The patient portal is equally driven by access rights. For referred patients, these rights are determined by the booking code received from the referring physician (see above). For patients entitled to do direct bookings for specific procedures (e.g. renal dialysis), the rights are determined by a booking code, obtained directly from the hospital. The functions of the portal are to enable the patient:

- to view his personal dashboard (booked appointments, pending referrals);
- to pick up a pending referral and to convert it into an appointment;
- to make a direct booking (without previous referral);
- to cancel or reschedule a booking.

All of the above functions are controlled by a sophisticated rules engine that determines who has access to what functions and under what conditions.

Every actor plays its role

The clue to UtraGenda's Appointment Storm is the extreme parameter ability of the rules – both at the level of the scheduling application UltraGenda Pro (the true 'heart' of the concept) and of the portal application UG Broka. In the solution each of the actors can play his 'natural' role – just as in the traditional process:

- hospitals *define* the rules of the game;
- referring physicians *refer* the patient online;
- patients *book* their appointments either via phone or online.

The role of the hospitals is critical. Both in the scheduling application UltraGenda Pro and in the brokering application UG Broka, they define important rules such as:

- the various referral protocols for each of the departments or clinics;
- the individual referring physician's access to specific protocol(s);
- the appointment types for which a referral can be converted online into an appointment;
- the relevant instructions/information provided in the referral and/or booking confirmation;
- the conditions under which the booking can take place, and in particular the characteristics and number of free slots offered;
- the conditions for cancellation and/or rescheduling.

When direct bookings (i.e. appointments for non-referred patients) are authorized further parameters include:

- the individual patient's access to the search engine for specific appointment types;
- the number of bookings a patient can make and 'as of when' bookings can be made and/or cancelled.

Appointment Storm in practice

Once the system properly configured, online referrals and bookings becomes a lean, smart process. Here is how simple it gets ...

① **The referring physician logs on to the hospital's (or region's) website ...**
After identification and authentication, the referral protocols to which he has access are displayed on his dashboard.

② **... and refers the patient**
He picks out a protocol, completes it and obtains instant authorization for referral. The authorization contains relevant instructions and information for the patient, as well as a DBC (direct booking code). The physician prints these out and gives them to the patient.

③ **The patient picks up the referral**
He logs on to the hospital's (or region's) website. After identification and authentication, the authorized referral is displayed on his dashboard.

④ **... and converts it into an appointment**
He hits the 'book' button, selects one of the slots offered and confirms the appointment. His upcoming appointment(s) and relevant instructions are available at all times on his dashboard. If authorized, he can cancel.

Notes

All of the above steps can be tuned to specific rules or requirements. A few examples:

- it is possible to prohibit online bookings, in which case the patient will pick up the phone, provide his DBC and arrange the appointment via a traditional dialogue;
- free slots offered can be limited (e.g. offer max. 3 free slots, never offer a slot earlier than 2 days after logon, etc.);
- cancellation of appointments can be prohibited (or only authorized min. 2 days in advance of appointment date);

Non-referred patients that are authorized to book (dialysis patients for example) receive their DBC directly from the hospital's department. Obviously, they can only book for those appointment types for which they are authorized.

Referring physicians can see 'pending' referrals on their dashboard, i.e. referrals that have not been converted into an appointment.

Benefits and further outlook

UltraGenda's Appointment Storm concept for online bookings made up by the UltraGenda Pro and UG Broka applications is nothing less than a revolution. Processes that have been conducted for decennia by telephone, pen and paper can now be safely carried out online at considerable lower cost and with even more respect for the rules of the clinics and their physicians.

Of course, the collaboration can go beyond the triangle patient-physician-hospital to include call centers, home- and specialized care, elderly homes etc. And soon, UG Broka will be able to interact with more than one instance of UltraGenda Pro at a time, thus giving the patient the freedom of choice (e.g. wait 8 days and go to hospital A, or wait 3 days and go to hospital B). The healthcare community at large can so benefit from a system that is reliable, secure and friendly, that restricts every actor to his 'natural' role and yet protects the rules of those most concerned, i.e. hospital clinics and physicians. Efficiency gains and service improvements are immeasurable.

With *Appointment Storm* from UltraGenda, the solution to transform business practices in healthcare is now available. Its effects can be dramatic. Now remains the task to open the minds for these opportunities, so that the entire healthcare community can finally enjoy the benefits of e-transactions, as other sectors of the economy do since years.

FOR MORE INFORMATION:

UltraGenda nv

B-9070 Destelbergen | Belgium

www.ultragenda.com
info@ultragenda.com

+32 9 326 30 30