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Healthcare Digital Transformation is a Must

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Abstract

Developed societies are facing an aging process caused by the increase in life expectancy and the reduction in birth rates, leading to a considerable increase in health and social care needs. On the other hand, developing societies need to drastically improve the medical care they provide their citizens and improve their standard of living. All this must happen with scarce and expensive resources. The lack of qualified staff, doctors, and nurses, is especially pressing. This is where technology provides new tools and solutions that allow us to introduce more efficient procedures. That is to say, correctly performing the tasks and work we face without wasting either time or energy. That is why we must innovate. This situation has become tragic when COVID pandemic has knocked.

Keywords: Birth rates; Social care; COVID pandemic

Introduction

Innovating means doing something differently. Innovating to be more efficient. For example, Christopher Columbus was an innovator. He discovered America by chance. He was searching for a shorter route to India, not a new continent. He was quite simply questioning the way something was being done, searching for a more efficient solution, a shorter path. He had an open mind. He was immensely successful, even if his achievement was not the one he expected, but one far greater. His eagerness to innovate made a great contribution to humanity [1].

Therefore, we are going to discuss how, once the evolution converging IP high capacity broadband and 5G telecom networks and unified communication and collaboration tools where created from innovation and implemented, that allowed us to improve productivity, security and efficiency in hospitals and healthcare organisations. Nowadays we name this evolution as Digital Transformation.

We cannot live without communicating with others. This reality is even more patent and critical in healthcare. On occasion, life or death depends on communication being conducted in a timely and precise manner.

Literature Review

Communication in healthcare in general and in hospitals in particular is of unique characteristics, which we sum up as follows:

- The high level of mobility of all those in the hospital, but the medical and technical management staff.
- A dynamic and complex directory, complicating communication. Patient registrations and discharges. In and out-patients. Hospital medical staff and visiting staff, whether agency or support staff shifts. It is difficult to be sure at all times with whom you can communicate and their availability [2].
- Mobile messages high volumes of short messages to mobile devices are produced.
- A large amount of machine and system data from two different origins.
- Patient follow-up (monitoring) it' doesn't matter where is the patient. The patient can be at home or at the workplace or in the street.
- Group communication is also very frequent. Different specialists must be consulted in real time. Second opinions are required.
- Communication traceability and auditing the great majority of communications should be registered in order to verify both to ensure correct action is taken and to facilitate the improvement of procedures. This is an obligatory requirement in all countries.

Digital tools at our disposal

In order to confront this complex and exciting reality, we now have powerful, reliable and cost-effective digital tools. These are IP telecom wire and wireless networks and Unified Communication and Collaboration applications (UC2). We are going to attempt to explain them. In doing so, we will draw inspiration from another historical figure, Antoni Gaudi. This amazing architect, the creator of the world-famous basilica La Sagrada Família, in Barcelona, sought inspiration in nature. Nature, created by God, is the force that has best resolved problems. We are going to use the same idea, the same anthropomorphic model to explain our new technological tools. Let's observe ourselves, our own bodies. What is our communications system like? What is our brain like? Our body's communications system is the nervous system. We have a single

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system that transports from sensors to the brain the different types of signals: Voice, video, touch, temperature, etc. They have an integrated communications system (**Figure 1**) [3].

When making decisions, our data centre, our brain, processes all of the available information from different sources. Our brain is conveniently protected by a bony structure, the skull. So, the servers should also be located in an appropriate place. Until a few years ago, we only had isolated systems in telecommunications. Systems that used different networka: A telephone network, a data network, a video transmission network (television). Each of these systems required different equipment. With converging IP systems we have finally achieved a solution equivalent to nature, a single network with a single protocol for the transmission of voice, data, images and control signals. A new generation of applications is to be developed to process the different types of information simultaneously [4].

Figure 1: Telecommunications are our hospitals' nervous system.

Unified communications and collaboration

My friend and colleague Marty Parker, from the Society of Communication Technology Consultants International, has shown us that implementing unified communications in an organisation is the introduction of new communication methods as another component in the sequence of tasks of a process so that said process becomes more efficient, i.e. so that the task is performed correctly and successfully without wasting either time or energy. We use components that once worked autonomously, and we integrate them. Efficiency in processes is what we need to tackle the challenges we face. Performing tasks in a more intelligent way (**Figure 2**) [5].

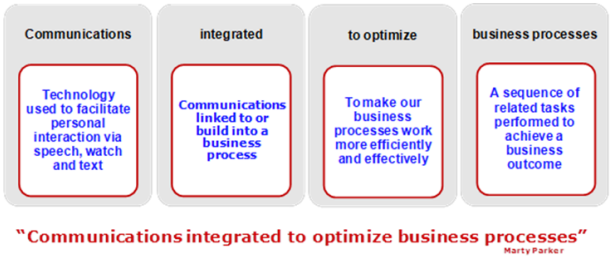

Figure 2: Unified communications definition.

The processes carried out in healthcare fall into two categories:

- Regular processes.
- Incidents and alarms, mainly medical.

Thanks to the UC2 tools and the integration between communications and IT that they provide, we can automate these two types of processes, with the aim of reducing their lifecycle and preventing errors. The key word is process and its corresponding flowchart.

Large communication capacity from any point

The wire and wireless broadband network enables the simultaneous transmission of voice, data, images and control signals, is no longer solely internal to the hospital, but rather extends beyond its physical limits, enabling connections among hospitals, primary attention centres and patients' homes at the same speed as within their premises, using the same protocols at all times. The 5G mobile networks guarantee also very low latency, an immediately response time. The integration between fixed and mobile communications is total, thanks to the fact that the unified communications server controls all communications devices and the communications flows produced. The large transmission capacity available allows us to enter the visual communication age, enriching personal relationships by providing considerably more data and the same time we are reducing physical mobility [6]. Neurolinguists are well aware that, of the three communications channels available to humans, the main one is the visual channel. The remaining two are auditory and kinestetic. Video calls and videoconferencing allow for more efficient meetings, sharing documents and graphic information. These are the so-called collaboration tools.

Digital architecture

The following diagram represents the digital architecture for healthcare. At the base of the architecture is the connection to the outside world, with Internet and other hospitals, centres or with patients at home. It is the WAN network that should be supported on fibre optics, operator services such as Carrier Ethernet or other broadband wire o wireless (4G, 5G) services. This type of solution facilitates a very high reception and emission capacity outside the centre or hospital campus. The difficulty stems from having these services available at a reasonable price. Although the price of broadband has

decreased considerably and fibre infrastructure has been greatly extended, there are still difficulties. It is important to have the support of experts in negotiating agreements with telecommunications operators (**Figure 3**) [7].

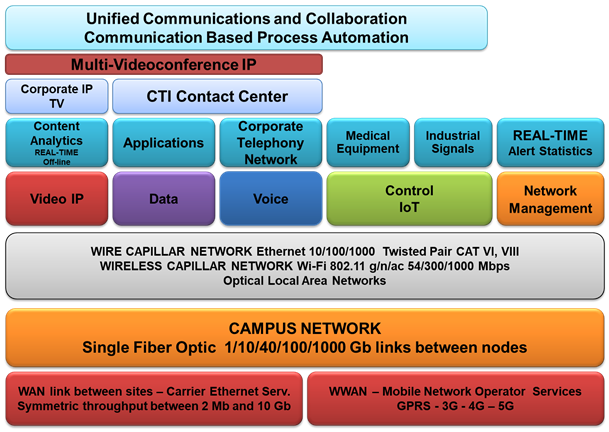

Figure 3: Digital architecture diagram.

A fibre optic network with Ethernet switches should also be introduced in the architecture's second level, within the hospital's premises or campus. In this case, because it is a private infrastructure, having a large transmission capacity is very cost-effective. The third level is the capillary network, allowing us to cover the entire premises in both the wire and wireless modes. As regards the capillary networks, although fibre optics is being introduced, structured copper cabling continues to be used in the majority of cases. It is advisable to install the latest standardised category (Cat VII or VIII). A Wi-Fi network will provide us with a wireless connection, and thus, with mobility. It is also recommendable to install a network with the maximum available capacity. You can therefore see how the same technology, Ethernet, and the same protocols, IP, are used across the three levels and that it is able to transport voice, data, video and control signals [8].

The different services are rolled out on the platform described above. The telephony, the video-security and the management information services. But the real opportunity comes from the fact that because all of this information is digitalised, we are able to integrate it and develop high value-added applications, such as intelligent alarm management, image recognition, multimedia customer care centres, tele-monitoring, tele-localisation, etc. By breaking free of proprietary, isolated solutions, we enter the world of continuous improvement offered by software, with a great ability to develop new applications and procedures. Connectivity and entertainment services for patients and visitors must also be considered. The management of the internal networks is more complex every day. More and more services must be supported [9].

Uncountable opportunities to improve procedures and optimise costs

As an indication, we can say that we can gather the information in real time in its place of origin, transport it to the processing centre, where the established rules and procedures are applied and that processed information is delivered to the appropriate person, regardless of where they are at that time. As an example, we are going to discuss a tele-monitoring and alarm management application. Our patient monitoring equipment is connected to the network and to the communications server. When an incident occurs, the system automatically advises the on-call nurse *via* a messag e sent to one or several pre-determined devices. The nurse must confirm receipt of the message and respond appropriately. The entire process is recorded. Consequently, there is no need for anyone to be in a control room waiting for an incident to occur, or to rely on anyone hearing an alarm ringing. The results obtained from introducing alarm management integrated with communications are spectacular [10]. These tools are sure and reliable. Its development begins more than ten years ago and had demonstrated its profitability for years. For example, the research carried out by Philips Healthcare in the United States, under the management of Dr Michael Breslow and presented in the eHealth conference in Barcelona in March 2010, ten years ago, concludes that the use of tele-monitoring systems reduces deaths in intensive care units by 20%, and reduces patients' stays in hospital by 30%.

“The data shows that 90% of the remote equipments’ interventions respond to problems identified by said equipment, and not by employees at the bedside, explains Dr Breslow. Furthermore, he goes on, this remote equipment deals with routine tasks where ICU employees cannot, even covering more than 100 patients with an intensive care physician and two nurses".

Discussion

Another simple example of how large savings can be achieved by simply introducing the measuring guideline once and in real time. If 300 patients are examined daily in a hospital, and if the doctor sets out the measuring guidelines or instructions for the nurse directly in the system instead of on paper, in addition to avoiding transcription errors by eliminating the administrative process and the introducing of new data in the systems. This simple change can represent a saving of 5 minutes per patient and prescription. Over a one-year period, that represents 9.125 hours/year of administrative work. The tele-localisation of equipment and people within the hospitals provides information at all times on where they are, guaranteeing their protection and rapid availability [11].

Beyond the hospital’s boundaries

Tele-monitoring and tele-localisation can be extended beyond the hospital's boundaries. The network is available everywhere. The fourth (4G) and fifth (5G) generation mobile communications networks have a large capacity to transmit voice, data, and video with very low latency. The European Community has set itself the objective of extending older people's autonomy as much as possible. To do so, the tele-monitoring of biomedical parameters and activity, cover over the dispensing of medication, the smart control of their homes (water or gas leaks, doors and windows, etc.) provide the necessary tools. They reduce the number of medical visits and the time each on takes. They also reduce hospitalisations. In this

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case, videoconferencing solutions facilitate emotional support and company, which is also very important for older people, and increases the abilities of people with reduced mobility (**Figure 4**).

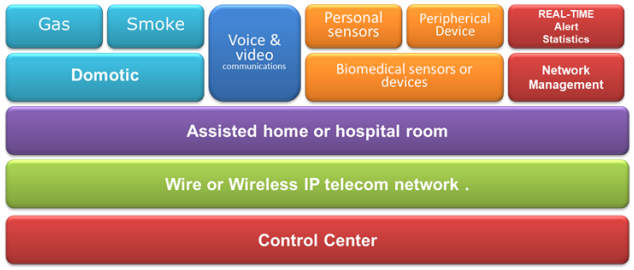

Figure 4: Tele-assistance solutions architecture.

Big data and artificial intelligence

The collection of huge amounts of real data thanks to the permanent monitorization of patients with chronical diseases will fuel research. The automatic collection of data not only allows real time alarms and immediate response to critical situation, also is building without errors, a big data. The analysis of all these data using artificial intelligence tools will help to develop new treatments, find unexpected relations and much better understand the factors that affect a disease (**Figure 5**).

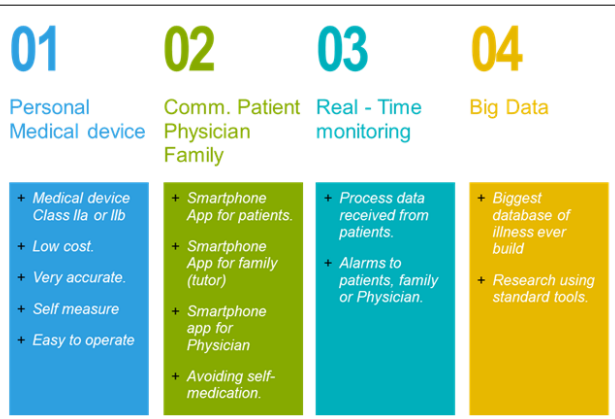

Figure 5: 4-modules of tele medicine.

The risk of not acting

On the other hand, we cannot forget that many current communications systems run a high risk of obsolescence and collapse. Significant mergers and even bankruptcies have taken place affecting well-known manufacturers. Many TDM telephone switchboard models and systems for locating individuals have been discontinued. Internal LAN's (Local area network) might be upgraded. The change from analogue solutions to digital ones is final and maintaining analogue systems or either first generation Ethernet switches represents assuming increasing maintenance problems due to a lack of replacement parts and qualified staff, a phenomenon known as "skill obsolescence". In order to minimize cyberattacks the telecom equipment must be permanently updated [12].

The resistance to change shown by both people and organisations is well-know and has been studied extensively. The easiest option is to stay in your so-called comfort zone. Therefore, to successfully introduce a change to working procedures based on the use digital tools like unified communications and collaboration solutions, the whole organisation must be onboard. This is not merely switching one electronic equipment for another one. It is a re-engineering of processes. It's a transformation process. Thus, the hospital's management, the healthcare services directors, must lead this type of project and guarantee the participation of the key people in the organisation, creating a multi-discipline team. The project must be very well explained and with great care within the organisation. Clear and realistic objectives should be set, a rigorous methodology applied, beginning with a detailed design, correct planning of the migration phase to avoid unavailabilities, acceptance and quality control tests should be conducted as well as result monitoring, applying the necessary adjustments. The results obtained are wonderful:

- Rapid response to incidents and alarms.
- Improved response times to patient requirements.
- Locating the right person at the right time.
- Automating daily workflows, improving efficiency.
- Improving teamwork. Facilitating the sharing of information.
- Access to resources from other, far-off hospitals, doctors, experts or equipment.
- Fuel research

Unified communications and collaboration are the right tools to meet these challenges which we could resume as:

- Improving the quality of patient care. Improving their level of satisfaction.
- Improving the level of satisfaction felt by the healthcare staff.
- Reducing costs and inefficiencies.

The challenges we face are of such a magnitude that we cannot do without the technological tools available to us. Investing in networks will allow us to improve our public or private healthcare systems and create wealth for our societies.

Interdependence, working in a network

To conclude, let's go back to the anthropomorphic model and observe how our brain is constructed. It is a network of interconnected neurons. The more connections between the neurons, the more developed the brain, the more knowledge, and skills that person has. The better the communications in an organisation, the more efficient it will be. Working in a team, working in a network [13]. The American intellectual, Steven Covey, author of the famous book "Seven Habits for Highly Effective People", explains this concept from another point of view. He believes that people are highly effective when they are interdependent, when they are able to collaborate with others. Therefore, improving communications in the healthcare environment is quite simply vital.

Conclusion

Developed societies are facing an aging process caused by the increase in life expectancy and the reduction in birth rates, leading to a considerable increase in health and social care needs. On the other hand, developing societies need to

drastically improve the medical care they provide their citizens and improve their standard of living. All this must happen with scarce and expensive resources. The lack of qualified staff, doctors, and nurses, is especially pressing. The COVID pandemic has exposed this situation dramatically. To face these great challenges, ICTs (Information and Communication Technologies) provide great tools and solutions that will allow us to implement more efficient procedures.

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