Boost the translation of Omics to the clinic environment
Deal with the unsustainable upward climb

Severe adverse drug reactions (SADR)

Are among the 10 main causes of death in the world. According to several studies, about 5% of all hospital admissions are associated with adverse drug reactions (ADRs)*.

Inefficient treatments

38% of depression patients, 50% of arthritis patients, 40% of asthma patients, and 43% of diabetic patients will not respond to initial treatment.

Late diagnosis

Women with certain **BRCA1 or ***BRCA2 gene variations have up to an 85% and 60% lifetime chance of developing breast cancer and ovarian cancer respectively.

Trial-and-error dosing prescription

Sensitivity to warfarin varies significantly in individuals, leading to 20-fold dose differences.


**BRCA1: Breast Cancer 1 gene

*** BRCA2: Breast Cancer 2 gene

Are you ready for the revolution?

To face the demands of an ageing population, the current healthcare system has to evolve towards a sustainable model focused on patient wellness. This “revolution” will only be possible by transferring the breakthroughs from the bench to the bedside yielding as a result the implementation of a new paradigm based on 4 pillars: predictive, preventive, personalized and participatory (P4 Medicine).

Atos will act as catalyst in the described revolution by building a solid technological bridge that will allow P4 Medicine to be a reality in few years.

Who said this would be easy?

Omic sciences, and in particular genomics, stand out in life sciences field. Genomics has developed at a very high-speed due to the dramatic drop in sequencing costs. When the sequencing costs reaches 100$, the way will be paved for each person’s genome to be sequenced as a part of standard healthcare procedures.

In the coming years, the world will be inundated with individual omic data. Omics avalanche introduces significant challenges which can only be addressed by means of a blend between Bioinformatics together with Information and Communication Technologies.
Challenges inherent to the genomic processing

There is a significant gap between the worlds of cutting-edge genomic research (bench) and everyday healthcare (bedside). To fill this gap, it is mandatory an active process of translation of genomics to the healthcare environments. Atos aim is to push this translation by building a technological bridge that will favor the implementation of P4 Medicine. This bridge is composed of three stages:

- **Data generation, storage and interpretation challenges**
  - Data produced from a sequencing run are large and unwieldy. The orders of magnitude to store the output from sequencers are measured in tens of Terabytes.
  - The assembly of millions of reads into a genome sequence requires substantial computational power. Assembly involves aligning the reads against a relevant reference sequence, and mapping them in the correct location in the genome. Alignment is made challenging by true differences between the reference and sample sequences, the highly repetitive nature of substantial portions of the genome, and short read lengths which mean that individual reads may map to multiple locations.
  - There is a lack of harmonised data retention period for medical data (Genomics data could be included in this category). In EU member states Genomics data retention depends on national and state regulations, which are subject to change over time.

- **Security, privacy and user access to genomics information (Genomics data is highly sensitive data) has to be managed in all workflows.** Following the guidelines set by Directives 95/46/EC and 2002/58/EC uniformly applied in Europe on the protection of individuals with regards to the processing of personal data and on the free movement of such data.

- **Data integration challenges**
  - Doctors can’t perform patient stratification based on clinic and genotypic criteria.

- **Data correlation challenges**
  - Late diagnoses, severe adverse drug reactions, inefficient treatments and trial-and-error dosing.

Atos helps you overcome these challenges

OMICS (Omics & Medical Integrated Compute System) solutions catalyze the translation of genomics to the clinical practice.

**OMICS ENTRY LEVEL (OMICS-EL)**

solves computation, communication and storage challenges by combining:

- Extreme computing & high performance communications.
- Managed, flexible, quick access storage capabilities.
- Green architecture design & associated services.

**OMICS-MASTER (OMICS-M)**

is a blend among our more powerful high performance environments, the best algorithms for genomic processing & a friendly viewer and advisory bioinformatics services.

**OMICS-CLINIC (OMICS-C)**

deals with data integration into the healthcare systems with the aim of facilitating the design of preventive strategies on patients’ groups on risk of developing disease.

**OMICS-INTELLIGENCE (OMICS-I)**

is an analytics engine supported by Big Data technologies that extracts information from the bulk of heterogeneous data sources generated in the pace of scientific and healthcare projects.
They are doing it!

**National Center for Genomic Analysis**

The number one in genomic production in Spain.
When you’re the number one genomics production center in Spain, overcoming computing and storage challenges is not just a necessity: it’s a fundamental obligation.

**The challenge:** Its capacity is more than 800 sequencing Gbases/day – equivalent to sequencing eight full human genomes a day.

**The solution:** Atos is helping CNAG in its mission to carry out large scale projects in DNA sequencing and analysis by providing a supercomputer featuring 1,200 processing cores and 2.7 Petabytes of storage.

**The result:** CNAG is the one of the most important Genomics Centers in Europe and it is a major contributor and driver in several larger international initiatives.

**Atos and the Prince Felipe investigation center**

Boost the translation of genomics to the clinic practice in Spain.
The Prince Felipe Research Center (CIPF) is a biomedical research Center, whose objectives are to take up new challenges in the basic research field and to promote scientific work of excellence.

**The challenge:** to create tools that will allow the management and the extraction of knowledge from huge volumes of heterogeneous data produced in the genomic processing experiments.

**The solution:** Computational Genomics chair focused in the optimization of algorithms for genomics data processing as well as the development of graphic viewers. The chair is a perfect blend between the Atos experience in High Performance Computing and the CIPF knowhow in Genomics.

**The result:** A step forward in the translation of genomics to the clinic practice and its adoption by the healthcare systems.

**Genyo**

The Centre for Genomics and Oncological Research (GENYO) is a mixed centre with stakes held by Junta de Andalucía the University of Granada and Pfizer. This centre has been devised as a space for excellence research in genomic medicine, focusing on the comprehensive study and understanding of the genetic basis of human diseases in general, placing special emphasis on cancer and its genetic disorders related to inheritance.

**The challenge:** Sequencing and further analysis is a key activity. The center has acquired new sequencing equipment and the number of sequencing projects has increased significantly. Therefore the current computing capacity needs to be updated to overcome the new computing and storage challenges.

**The solution:** Singular HPC cluster that provides with an elastic and versatile computing environment to remove bottlenecks in sequence analysis with a centralised storage solution.

**The result:** Genyo promotes the development of clinical research in genetics and genomics aimed at resolving citizens’ health problems.
The Research healthcare Institute 12 de Octubre releases

Its platform for genomics analysis.
The Research Institute 12 de Octubre hospital (i+12) was created the 15th December 2009 as a functional structure aimed to become in a reference centre in multidisciplinary Biomedical Research in the fields of clinic and translational research at the national and international level.

The challenge: To provide genetic diagnostic services based on massive sequencing to the different hospital departments.
The solution: Infrastructure based in extreme computing, networking and high performance storage.
The result: Removal of bottlenecks in genomic analysis, centralized storage and rapid transfer of data.

IT4I appointed as a reference centre

For the processing of genomics data
IT4I is a National Supercomputer Center located at Ostrava (Czech Republic) whose mission is to deliver scientifically excellent and industry relevant research in the fields of high performance computing and embedded systems. IT4I ambition is to improve the quality of life, to increase the competitiveness of industrial sector and to promote the cross-fertilization of high-performance computing, embedded systems and other scientific and technical disciplines.

Challenge: Lack of experience in the field of bioinformatics, need to develop a pipeline to carry out the genomics data analysis and disseminate the new capabilities in genomics among the potential users.

Solution: Implementation of OMICS MASTER solution. CIPF and Atos implement a pipeline developed in the framework of the Computational Genomics Chair and teach a training course for the IT4I staff.

Result: IT4I, a reference center for genomic processing.

The institute of biomedicine of Seville

Boost the European project ITRIBIS
The Institute of Biomedicine of Seville (Instituto de Biomedicina de Sevilla - IBiS) was conceived as a multidisciplinary biomedical research centre within the complex that houses the Virgen del Rocío University Hospital, a centre of high-level care, education and research. Its principal objective is to undertake competitive research at an international level on the causes of the most prevalent pathologies in the population, and to develop new methods for their diagnosis and treatment.

The challenge: Need to centralize in an efficient and scalable way, the storage of the data produced in the different departments.
The solution: Centralized storage.
The result: Starting up of The European Project ITRIBIS “Improving Translational Research Potential at the Institute of Biomedicine of Seville”, envisaged to enhance the IBiS’ excellence to become a reference of biomedical translational research applied to prevalent diseases in South Europe, to improve the transfer of results and, thereby, increase the production of benefits for the Region.
OMICS will allow the transition towards a P4 healthcare system where new challenges will be brought out as

Dr. Martínez Story
Dr. Martínez is sitting down with his laptop. On the website that he uses to manage his practice, an alert pops up warning him that several new mutations found in 10 percent of people have been discovered to be associated with the likelihood that they might convert to type 2 diabetes. All of his patients have had their entire genome sequenced and entered into their electronic medical record. He conducts a quick search of this 2,000 patient database and finds about 80 who are at risk (P4 medicine predictive pillar). To half of those patients, he sends a strong reminder and advice on diet and lifestyle choices they can take to avoid the disease (preventive pillar of P4 medicine). To the other half, whose medical records reveal pre-diabetic symptoms (P4 medicine personalised pillar) he sets up appointments to consider more proactive treatment with drugs that can prevent the onset of the disease. Patients could download an app certified by the healthcare system that will allow Dr. Martínez the remote monitoring of their glucose blood levels (P4 medicine participatory pillar).

* Based on “The case for Personalized Medicine”. Personalized Medicine Coalition, 3rd edition.
Atos: present in the entire process

Atos builds the technological bridge that pushes the translation of Genomics to Healthcare Environments favouring the implementation of P4 Medicine. Leveraging Bull technologies, Atos ensures pioneer solutions for each one of the four pillars that compose the P4 medicine with the final aim of boosting a sustainable healthcare model based on wellness that will allow facing the requirements of an ageing population.

Atos boots P4 medicine

OMICS (Omics & Medical Integrated Compute Systems) solutions, brings together Atos capabilities in Extreme Computing, Big Data, Networking, Security & Cloud needed to overcome the challenges in data generation, storage and interpretation to pave the way for further integration in the systems and correlation with heterogeneous data sources.
About Atos

Atos SE (Societas Europaea) is a leader in digital services with revenue of €10 billion and 86,000 employees in 66 countries. Serving a global client base, the Group provides Consulting & Systems Integration services, Managed Services & BPO, Cloud operations, Big Data & Security solutions, as well as transactional services through Worldline, the European leader in the payments and transactional services industry. With its deep technology expertise and industry knowledge, the Group works with clients across different business sectors: Defence, Financial Services, Health, Manufacturing, Media & Utilities, Public Sector, Retail, Telecommunications and Transportation.

Atos is focused on business technology that powers progress and helps organizations to create their firm of the future. The Group is the Worldwide Information Technology Partner for the Olympic & Paralympic Games and is listed on the Euronext Paris market. Atos operates under the brands Atos, Bull, Canopy, Worldline, Atos Consulting and Atos Worldgrid.

For more information, visit atos.net

About Bull, the Atos technologies for the digital transformation

Bull is the Atos brand for its technology products and software, which are today distributed in over 50 countries worldwide. With a rich heritage of over 80 years of technological innovation, 2000 patents and a 700 strong R&D team supported by the Atos Scientific Community, it offers products and value-added software to assist clients in their digital transformation, specifically in the areas of Big Data and Cybersecurity.

Bull is the European leader in HPC and its products include bulpx, the energy-efficient supercomputer; bullion, one of the most powerful x86 servers in the world developed to meet the challenges of Big Data. Evidian, the software security solutions for identity and access management; Trustway, the hardware security module and Hoox, the ultra-secure smartphone. Bull is part of Atos.

For more information, visit bull.com