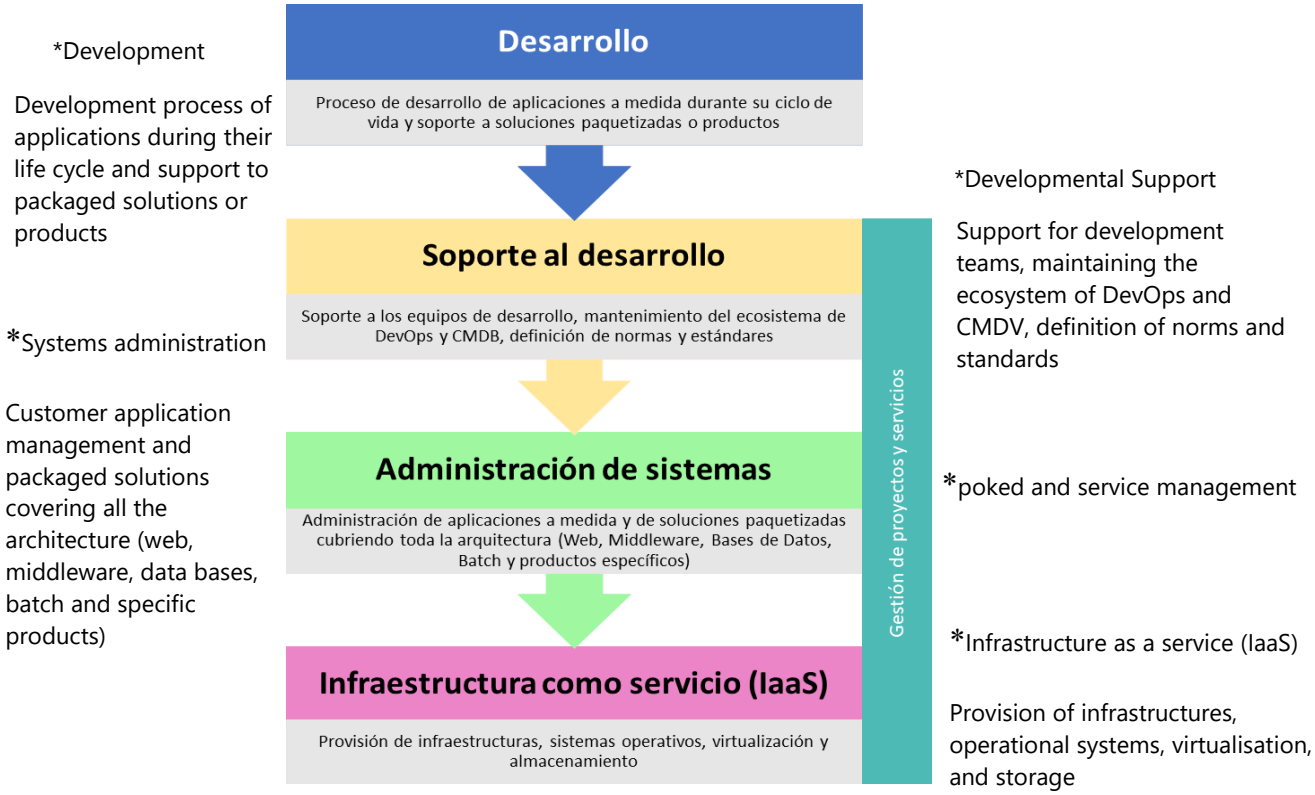
Transformation of the technological infrastructures of the City Council of Madrid - MadridMultiCloud

The General Directorate of the Digital Office and the *Informática del Ayuntamiento de Madrid*, called the Autonomous Information Technology Organisation of Madrid (IAM), have the mission of promoting the digital transformation of the city of Madrid and improving the services of the City Council of Madrid in an increasingly digital scenario, with a culture of citizens and public employees that has changed rapidly as a result of the pandemic. In order to achieve the objectives derived from the strategy, IAM has a methodological framework for managing the catalog of services and the portfolio of projects that allow the provision to be organised with the participation of the different units of the Autonomous Organisation and to evolve or create new services through portfolio projects that come from demand management transmitted by government areas and districts, or from internal initiatives of technological evolution.

The volume and diversity of services that are addressed to almost thirty thousand municipal employees, millions of citizens who reside in or pass through the city of Madrid, with nine government areas with highly varied powers, make the technological ecosystem complex and demanding in its maintenance and evolution. This is because the objective is to position Madrid as a digital city of reference at the forefront of technology. In order to align with the needs of the organisation, IAM has three Sub-Directorates General for development that have powers over the applications and packaged solutions that are grouped in the areas of city management and urban planning (MiNT Platform – Intelligent Madrid, information systems geographic), sectoral services such as social services, cultural and sports activities, Digital Administration services or electronic processing through own developments or solutions that come from the General State Administration, and information services or citizen attention and portals, and systems internal management of the Treasury and Human Resources, hiring, economic management and income (taxes and fines).

In the areas indicated, we can find innovation projects which are promoted by the Digital Office with a special focus on advanced data analytics, mobile applications, robotisation (RPA) or artificial intelligence.

From the General Sub-directorate of Systems and Technology of the IAM, in collaboration with the units responsible for communications, user post and cybersecurity, services are provided to the development teams through a catalog of services, a set of systems techniques and a wide stack of technologies. These cover the history of computing, from *legacy* systems such as the mainframe to container-based applications, through virtualisation and open systems as the most widespread ecosystems.



Layers of the service model of the General Subdirectorate of Systems and Technology.

In addition to the services provided to the development teams, the General Sub-Directorate for Systems and Technology has a Printing and Envelope Center, a postal service management department, the traditional internal mailbox for the City Council offices, and digitisation and recording of documents, for all the organisation's processes that still require the paper channel for communication to citizens through ordinary letters or administrative notifications and the conversion from paper to digital through high-production scanners.

The road to the cloud, Madrid MultiCloud

The digital services of the Madrid City Council are based on an infrastructure of *on-premise* data centres that make up the private cloud that provides computing and storage infrastructure services to system administrators to design and build the services required by development teams. In the last three years, a plan for improvement in the private cloud sector has been promoted. It includes two steps: a first step towards the consolidation and virtualisation of physical equipment, going from 458 physical devices to 235 in the main Data Centre to reach an infrastructure that currently has more than a thousand virtual servers. Within these services, there are essentially no services left without virtualisation. The second step involves the technological renewal with which the capabilities of providing service from the two data centres are improved in high availability and of resilience to incidents or continuity to disasters in which Informática Ayuntamiento de Madrid has invested more than five million euros during the year 2021.

Since the public portals of the Madrid City Council, accessible to citizens, and the Ayre municipal intranet were moved to Opentext's cloud more than five years ago, the IAM's private cloud has been linked to other data centres and public clouds. Once the path began, the IAM's strategy has been to evaluate if the cloud is a suitable tool or lever for each service that requires a process of technological evolution.

The City Council of Madrid Internal Management Transformation Project aims to improve human resource management processes, economic-financial management, and income from taxes and fines. From the data centre transformation point of view, the project has already passed the milestone of evolving the *on-premise* SAP infrastructure that supports human resources processes and economic-financial management to SAP Hana Enterprise Cloud on Azure. It is a strategic project for the IAM in which Minsait is a technological partner, with a contract of 29.2 million euros for five years.

As a parallel action to the Internal Management Transformation Project in which the income processes (taxes and fines) will be transferred to SAP from the *legacy* environments of the manufacturer IBM in which they are currently located, the migration of the mainframe has been carried out and from IBM Power systems to Kyndryl data centres, the company that emerged as a split-off from IBM in the field of infrastructure services. The main objective of this migration project is the technological evolution of IBM platforms to keep them in support conditions from the manufacturer, as well as high availability and continuity in case of disasters.

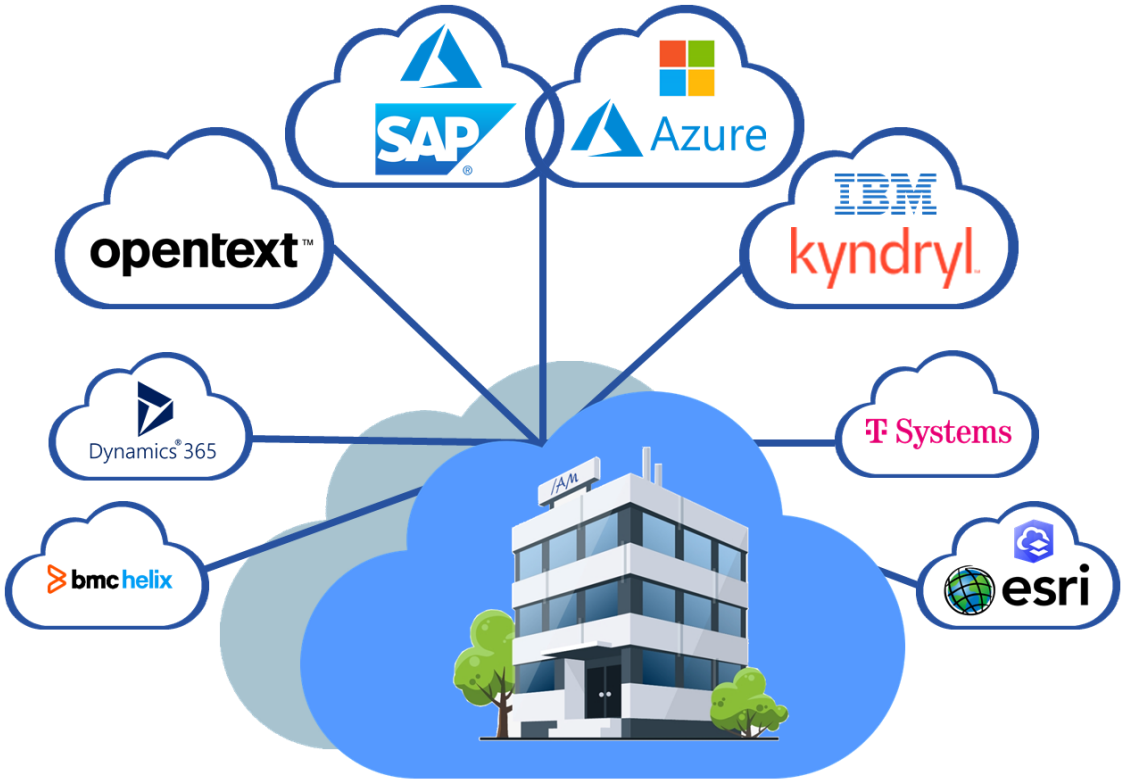
The workplace transformation that IAM began in 2020 and, at a pace accelerated by the pandemic, has brought the City to nearly 30,000 Office 365 subscriptions in operation, a migration of ITSM tools to public cloud (SaaS) with BMC Helix, and some Azure services that have sprung up around the desktop. Among these services, we can highlight desktops as a service in Azure (Desktop as a Service, DaaS) and Power BI data visualisation tools. The use of Power BI and other technologies available in Azure is part of the initiatives to transform traditional data analytics towards advanced data analytics, aligning with the Digital Office strategy. ITSM platform to BMC Helix as SaaS and an IT Support Portal has been launched.

In addition to the advanced data analytics projects in which Azure services are being used, IAM is working on a mobile app deployed in Azure. The app is aimed at social services to connect the elderly who request it with Volunteers for Madrid, and on a pilot process robotisation project (RPA) in Azure for the automation of the treatment of judicial notifications in the legal department of the City Council of Madrid.

Finally, as part of the city and urban planning services, IAM has a platform for geographic information systems based on products from the manufacturer Esri. Thanks to the cloud services of Esri ArcGIS Online, the City Council of Madrid managed to achieve the scalability of the infrastructure necessary to provide the service of maps and clean streets during the Philomena storm at the beginning of 2021.

The road to the cloud has already come a long way and the Madrid MultiCloud initiative is included in the Recovery, Transformation and Resilience Plan of the city of Madrid. It is part of the line of action of digital, intelligent and transforming Madrid in the objective of being a city with the best digital infrastructures, along with the infrastructures and developer centre of Madrid solutions and the Madrid cybersecurity operational centre. With the Madrid MultiCloud project associated with the recovery and resilience funds, the aim is to advance on the path towards flexible and resilient technological infrastructures that accelerate the digital transformation of the Madrid City Council, improving environmental sustainability and reducing energy impact. The main priorities of Madrid MultiCloud are the secure connectivity node that allows connection to the most important public clouds with the necessary security measures to face cybersecurity threats, cloud platforms and services that support enabling technologies

advanced data analytics and artificial intelligence, mobile applications with containerised infrastructure and DevSecOps development support environments.



Madrid MultiCloud conceptual diagram.

DevSecOps, a paradigm shift

Paper is the universal medium, development teams worry about delivery times of functionality to the user, end users are unaware of the significant effort required during the life cycle and the writer of these lines looks sideways at the City Council's services availability monitoring panels. The objectives of the different units involved in any information technology organisation act as an ecosystem of forces and counterforces in which ensuring balance and long-term sustainability is a complex task. In Informática del Ayuntamiento de Madrid, especially in the relationship of development teams with systems, the aim is to eliminate bureaucracy that does not add value (Lean approach) and to be more agile by reducing *time to market*, relying on the use of collaborative tools and improving knowledge management.

To improve the efficiency of development and the exploitation of applications in production, work is being done on a new development framework with Angular technology in the frontend and Java in the backend. The framework is led by the IAM Management and the General Development Sub-Directorate responsible for application architecture and is based on the principles of high productivity, ease of learning, exclusively covering essential aspects and with autonomy to deploy in all environments by the development teams. Given that the General Sub-directorate of Systems and Technology's goals are availability, security, technological evolution and agility, it is crucial to standardise custom developments through the *framework* in order to make it easier to maintain such a large-scale and heterogeneous infrastructure with more than five hundred applications and packaged solutions hosted in Madrid MultiCloud.

Objectives of the General Sub-directorate of Systems and Technology.

The DevSecOps paradigm's agility in delivering technological infrastructures for the development and implementation of systems requires a more flexible and fluid organisation where the systems personnel are changing dramatically to adapt to technological change and maintain relationships with multiple interlocutors in the development teams.

The City Council must make a significant effort to maintain constant updating in order to continue in the manufacturer's support life cycle and eliminate obsolescence at an increasingly frenetic pace imposed by the technology sector and market trends in order to improve the availability, security and technological evolution of the digital services it offers to citizens, such as those intended to support the business processes of the various administrative units of the council.