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Opinion

The Uruguayan Digital Data Journey

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Currently, Uruguayans use technological solutions in their everyday lives so much and in such an intensive manner that they have turned Uruguay into the most advanced digital society in the region. Furthermore, Uruguay has received international recognitions for the quality of its digital government, information security, interoperability, citizen service, e-participation, online services, personal data protection, access to public information, and electronic signature solutions. These advances have allowed the country to quickly improve its position at an international level, making a difference due to its innovative approach to Digital Government policies and to digital technologies' applications while keeping the focus on citizens. This article summarizes the journey of Uruguay from the data perspective in order to achieve such success.

Digital development is not politically neutral. That is why in Uruguay, the challenge lay in being able to approach technology transformation as an inclusive social project. The goal of bridging digital gaps first appeared on the political agenda a decade ago, and through successive digital agendas, it has kept pace with the political cycle and become fully entrenched in government priorities.

Over the past decade, Uruguay has undergone a period of significant tangible and visible digital development in various fields. Ensuring the population's access to digital technologies and bridging the digital divide have been priorities, addressed through different public policies with the aim of guaranteeing the citizen's right to the opportunities that the Information and Knowledge Society offers. The progress achieved over the last few years includes wide coverage in telecommunications infrastructure; every household is in the process of being connected with fiber optics; free internet plans are being offered to the population; connection rates are the lowest in the region and at the highest speeds; all children attending public schools have their own computer with internet connection which they share with their families; the population has basic digital literacy skills; and outstanding initiatives are being carried out such as the traceability of individual livestock, the digital government strategy, and the national electronic health record.

Fostering the digitization of all government services was one of the 2020 goals of the Uruguayan Executive and one of our main tasks. Digital transformation with social equity—including the strengthening of specific skills, the full integration of technology in productive sectors, and the deepening of the link between citizens and the State—is a priority for Uruguayan government within this context.

AGESIC (the Agency for e-Government and Information Society at the President's Office, formed in 2005) leads the e-Government implementation strategy in the country as the basis of an efficient, citizen-oriented state and promotes the Information and Knowledge Society as a new form of citizenship, encouraging inclusion and engagement through the proper use of information technologies and communication. The agency seeks to digitize all public services available to citizens, from access to a housing loan or a birth certificate to education enrollment. This initiative provides for citizens benefits related to reducing costs and waiting times, availability (24 h a day, 365 days a year anywhere), reducing territorial gaps, and concentration of services in the capital and diversity of service channels. The data strategy employs "digital government assets" (agenda, electronic signature, access control, interoperability platform, and e-form, among others) to ensure government services are carried out in a traceable, interoperable, accessible, and reusable way that complies with security standards in order to achieve consistent results in delivering government services.

The digital ecosystem is supported by a legal framework, regulating the exchange of information and security policies that must be adopted by all public entities. It also regulates the protection of personal data and mechanisms to access public information and establishes the principles for the proper management of data.

Carrying out these initiatives necessitated the designing of a framework to standardize the modeling of public organizations, from their business processes to their supporting infrastructure. The Open Group Architecture Framework (TOGAF)[1] was adapted to enable the development of the Uruguayan e-government architecture, given the context of the existing structures and systems. It includes models, standards, politics, products, best practices, and recommendations in order to guide public organizations in the design of technical solutions in such way that promotes interoperability and an efficient use of information technology (IT) resources.

In 2017, this initiative was presented in The Open Group conference "Making Standards Work e-Government" in Ottawa, CA, USA. In 2018, The Open Group recognized the initiative and gave it the Enterprise Architecture for the People award.[2] The initiative was also published as a case study.[3]

A Technical Introduction to the Digital Platform

Uruguay has developed a digital platform (DP) which defines and implements standards and solutions for the development

of the digital transformation of government agencies. The DP is divided into two logical layers and a physical one. The physical layer is a Cloud (Government Cloud), which delivers services such as Infrastructure as a Service (IaaS) and Platform as a Service (PaaS). This implementation offers an infrastructure strategy that optimizes the resources and simultaneously simplifies management and governance. The logic layers are the interoperability platform and the crossed applications layer. The Interoperability Platform (Figure 1) is the implementation of the integration service strategy for backend systems, while the crossed application layer is the implementation of the Software as a Service (SaaS) layer of the Cloud.

In Uruguay the data exchange model is decentralized; the Interoperability Platform is shared and acts as the standard for the exchanging of data between all governmental and public agencies.

The interoperability infrastructure was launched in 2008 but only began to be widely used in 2016. This is due to the different technology maturity of public agencies, the "silos" generated by bureaucracy, and the lack of trust in exchanging the information and in the whole-of-government approach. Today, the platform exchanges over 10 million transactions per month with over 100 entities connected. It supports important projects; for example, each child born in Uruguay is registered with the Ministry of Public Health, and, through the sharing of data, a civil identification number is immediately generated in the public registry.

The platform integrates systems across the State at a backend level. It is divided into two layers: an interoperability layer (semantic and technical) and a security layer. The semantic interoperability is solved by the metadata definition of common data objects. Those definitions are made in agreement with all agencies involved in the use of that information and published in the form of a data dictionary, an xml schema, and a uml object diagram. The technical interoperability is implemented with an Enterprise Service Bus (ESB) accompanied by a set of definitions based on open standards. This simplifies the exchange of data between the systems of public organizations as well as the ability to add value to the process.

All exchanges over the platform are based on Web Services (WS) Soap1.1 and comply with WS-Basic Profile 1.1. Message delivery is implemented using WS-Addressing standards, which provide the capacity of dynamic routing. The security layer covers physical security and logical security. SSL v3.0 (HTTPS) with mutual authentication is used for the physical transport security. Logical security covers authentication and authorization of services. This is carried out by Security Assertion Markup Language (SAML) 1.1 tokens, which are exchanged by the platform using WS-Trust and WS-Security standards. In order to ensure token authenticity, an E-signature through certificates X.509 v3 is used. Communications within security components are held using eXtensible Access Control Markup Language (XACML) 2.0. We are also beginning to use the representational state transfer (REST) services with OAuth tokens. Open standards allow universal use of the platform, becoming independent from proprietary protocols and overcoming difficulties at the integration stage Figure 1.

Legally, the data sharing model requires that each exchange must be made between two entities (public or private) registered in the public records. To accomplish this, we require each exchange to be signed with a digital certificate that legally represents the entity. The entities authorized to access the platform are those that provide a public service. The platform allows access for the private sector only for when the data concerned is owned by public entities that request the access under the same security conditions.

For research institutes and those not providing public services, there is an open data catalog available. This was launched in 2012 and is a multi-tenant platform implemented based on CKAN (ckan.org). Uruguay has promoted an open data policy since 2011, and Law No.19,355 (Article 82, 2015) requires public entities to publish information related to active transparency in an open format.

Utilizing Personal Data for Policy Development

One of the main goals pursued in the Uruguayan digital government strategy is the development of a smarter government through the intensive use of data, the predictive analytics for proactive services, and evidence-based decision-making. Each of these requires extensive use of personal data, and consent is a key topic in these designs of data-sharing models. It always depends on the purpose for which personal data was given and the provisions and protection of the law.

This led us to the development of a National Data Strategy and Policy, which gives guarantees to public agencies in the use of the data for policy-making—Not only for adopting a data-driven government but also for establishing fundamental principles such as data as a government asset, data quality management, data interoperability, privacy by design, open data by default, and data preservation. The strategy also developed principles in the context of artificial intelligence (AI) that give citizens the guarantee that the public sector is going to make equitable, ethical, and transparent use of AI for decision-making. This was made possible because Uruguay has been a leader in Latin America in personal data protection since 2008, promoting the law 18.331, which is considered equivalent to the European General Data Protection Regulation (GDPR).

The Uruguayan strategy is citizen-centric and proposes a conceptual model called "Data-Based Digital Transformation," which recognizes data as a key resource for public entities enabled through the digital government. Digital transformation is designed to involve and empower citizens in the management of their personal data, to enable citizen participation in the formulation of public policies by opening data, and to use users' perspectives in the design of public policies and services.

In 2018, the strategy was presented in the closing panel of the Semantic Interoperability Community (SEMIC) Conference, held in Sofia, Bulgaria.[4] Following this, an agreement was signed between our country and Directorate General of Information Technology of the European Commission (DIGIT) for cooperation and to promote the exchange of experiences and the interoperability of systems between the European Union and Latin America and the Caribbean.

The Data 360° Initiative

Uruguay became a leading digital government in 2018, globally recognized as part of the Digital Nations group along with Canada, Estonia, Israel, Mexico, New Zealand, Portugal, South Korea,

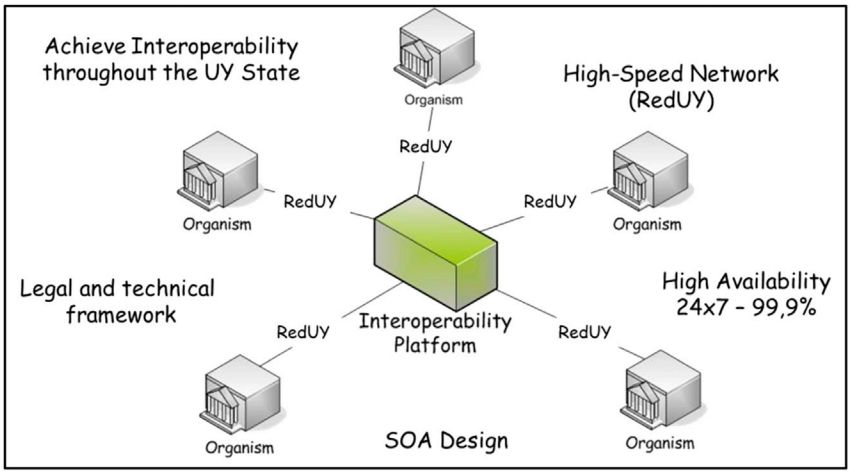

Figure 1. Platform Overview
A representation of a high overview of the Uruguayan interoperability platform and its main characteristics.

Denmark, and the UK. Within this group, Uruguay, through AGESIC, led a thematic group called Data 360° which sought to develop a holistic approach of data management for the public administration (PA). In 2019, the group achieved the signing of the Montevideo Data Declaration, where members of the Digital Nations recognized and affirmed a common data vision and data principles laid out in the Declaration.[5]

The Data 360° initiative was first developed in Uruguayan government, establishing a common understanding of data and how it is created, collected, managed, governed, shared, and used, with the aim of improving service delivery, better informing decision-making, improving operations, promoting innovative research and development, and building trust through transparency and accountability.

The initiative emerged through the evolution of the role of government in the digital age, where governments are generating, collecting, and processing an increasing volume of data. The adoption of digital technologies (such as putting services online, procedures, or the incorporation of the Internet of things [IoT]) entails the generation of large volumes of data associated with interactions between citizens and the government. This results in the need to improve processes, capacity, and governance while ensuring adequate protection of people's rights and managing the impact in all areas of human life.

The Impact of Artificial Intelligence on Governance

As a leader in Digital Government, Uruguay has identified the potential impact of AI and is preparing to incorporate it into the government infrastructure. At present, AI creates opportunities to incorporate new forms of analysis and improve use of existing information by adopting a proactive attitude with the ability to anticipate people's needs or prevent problems. These skills strengthen the development of public policies and consolidate a closer relationship between people and the State. Within the context of the intelligent government, AI appears as a technology conducive to implementing more efficient and innovative services.

However, AI also poses challenges and risks that need to be considered when developing a solution based on this type of technology. As part of the Digital Policy of Uruguay, the implementation of AI in PA requires the definition of general principles that guide the digital transformation of the government and the development of a framework to use it in the public sphere. In addition, it is necessary to have a clear strategy in place that incorporates different visions and considerations for the development and responsible use of this technology.

The AI strategy[6] presents the roadmap through an open construction process and shares what has been discussed with different stakeholders to obtain their vision and contributions, both nationally and internationally. This is the kickoff phase of a process that will enable Uruguay to continuously monitor and evolve the use of technology to ensure the successful digital transformation of the PA in the country.

Today, Uruguay is committed to the development of a Government as a Platform, which makes government data available to leverage innovation and business. Reorganizing the work of government around a network of shared application programming interfaces (APIs) and components, open-standards, and canonical datasets so that civil servants, businesses, and others can deliver radically better services to the public more safely, efficiently, and accountably.

Closing Remarks

> … not a new kind of government; it is government stripped down to its core, rediscovered and reimagined as if for the first time.—Tim O' Reilly (*Open Government: Collaboration, Transparency, and Participation in Practice*)

In Uruguay, the development of digital government has gone through several stages, from the foundational (creating the necessary structures for its operation) through the digitalization of government processes to the current digital transformation that comes to question and reimagine its structures and processes. What stands out in Uruguay is the vision that underlies these stages which seeks an equitable digital transformation centered on citizens and respecting their culture, their social and economic development, and the rights of all to the opportunities provided by technology.

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About the Author

María Laura Rodríguez Mendaro is a Deputy Chief Technology Officer and IT Chief Architect. She is a Computer Science Engineer with vast experience in the design and development of information systems, and she specialized in interoperability and integration of software solutions. She joined AGESIC—the eGovernment Agency at the Presidential Office—and belongs to the team that has allowed Uruguay to become a leading digital government that is globally recognized as part of the Digital Nations group along with Canada, Denmark, Estonia, Israel, Mexico, New Zealand, Portugal, South Korea, and the UK. She has also been a leader in the development of the national data strategy and data policy in Uruguayan government as part of a digital government strategy.