Coronavirus UY App: Behind the Screens

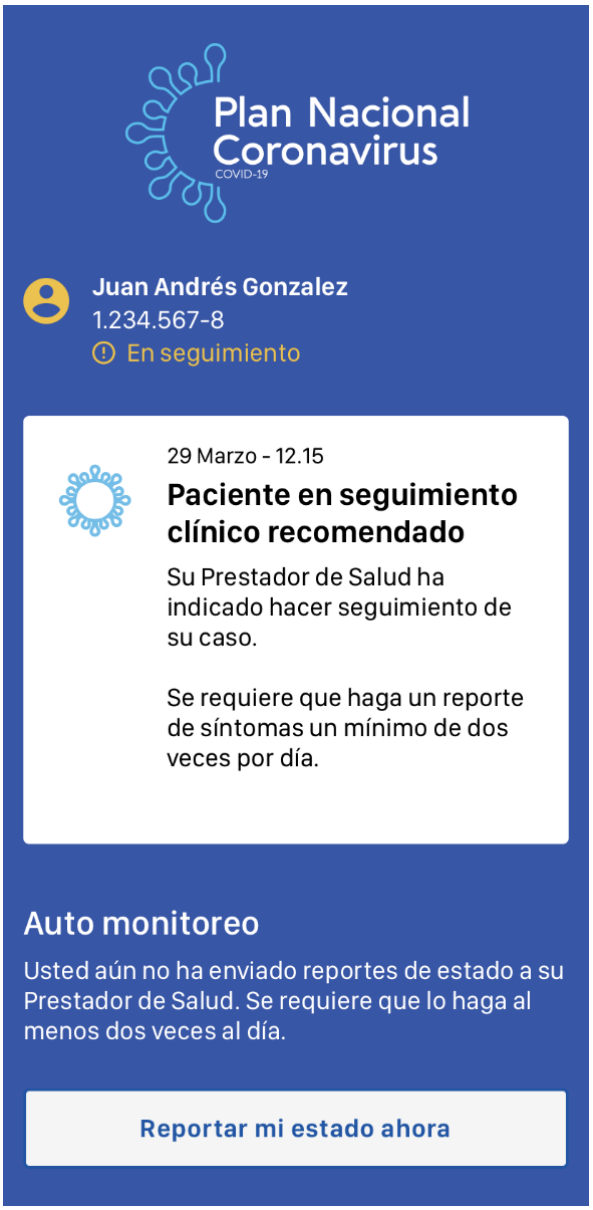
Now that the second stage of the Coronavirus UY application is live, I'd like to tell you the story behind the app of Uruguay's Coronavirus Plan, and maybe give you a glimpse of why this app is considered unique in the world.

A short introduction to the app: Coronavirus UY provides a secure method of self-assessment for COVID_19 without overloading phone lines and avoiding the movement of people, in order to improve care for those who suspect they have COVID-19. Also, it now offers new features such as drive-through testing and telemedicine for patients who tested positive. The system, which has already been downloaded by more than 250,000 users, optimizes communication between citizens and health services by assisting those who require a medical evaluation. A recent update incorporates the following features:

- Official data chart
- Telemedicine (remote monitoring of patients by doctors, including the use of video calls, biosecurity)
- New Clinical Follow-up Inbox for care providers
- Drive-through testing (people can get tested at a testing site without getting off their cars, biosecurity)

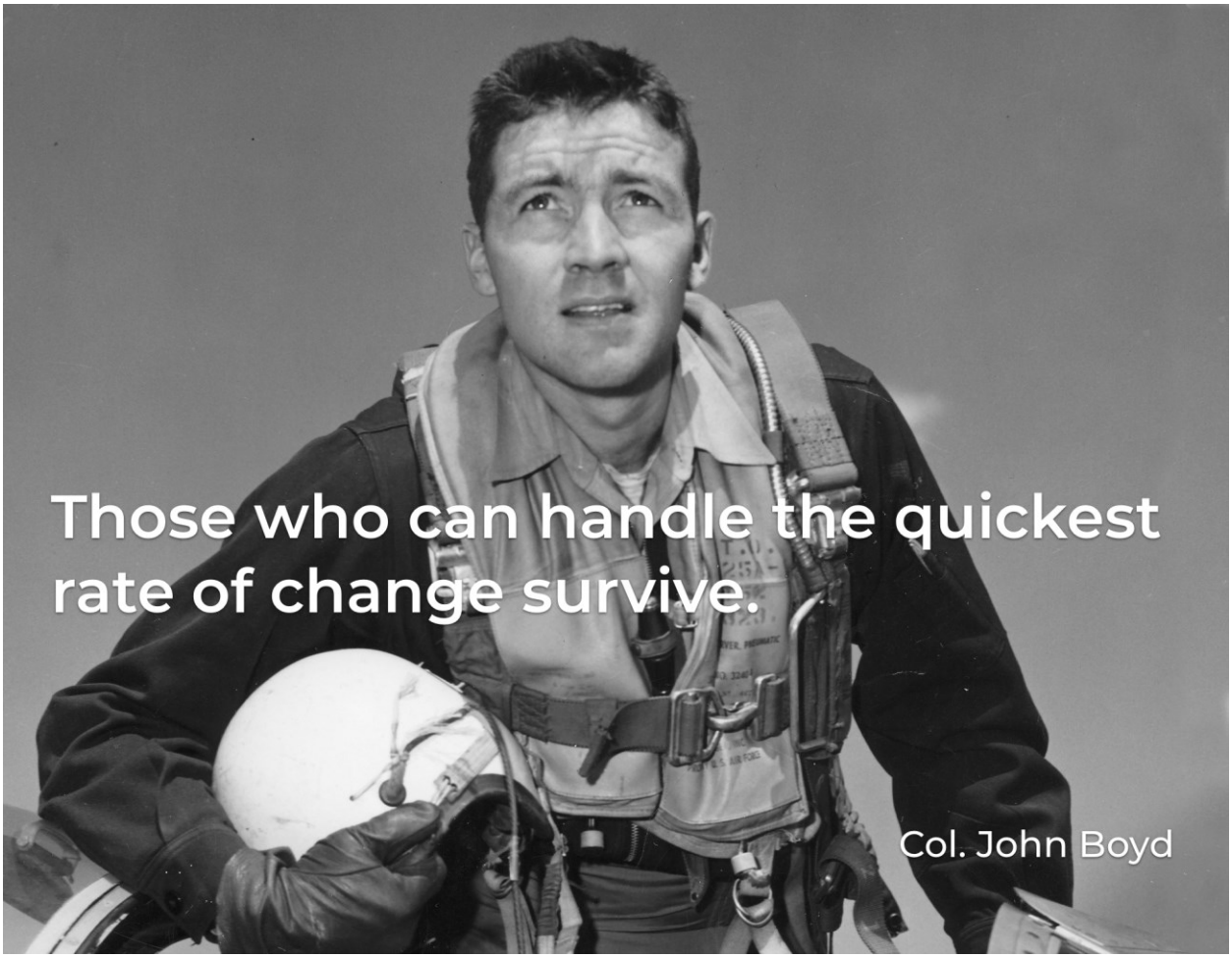
All right, let's now go "behind the screens" :)

(The images in this article are for information purposes only. The objective is to illustrate ideas and no real data or final implementations are displayed.)



As we all have known for some time, the world is currently experiencing total uncertainty.

According to U.S. Air Force Colonel John Boyd, priorities should be *people first, ideas second, and things third*. In other words, in order to achieve success in the midst of uncertainty, first we need to worry about what people we have, then what ideas we have, and only thirdly what tools we will use to go to war.



People

So, let's start by focusing first on those who interacted with the project, within different companies and from different backgrounds. Some of them got involved in the early stages, and others later on. Also, there are probably many more, but here is a list of those I know are working on this (please excuse any omissions):

Uruguay’s Presidency, Salud.uy, AGESIC (Agency for Electronic Government and Information and Knowledge Society), MSP (Ministry of Public Health), SINAE (National Emergency System), Claro, ANTEL (state-owned telecommunications company), ITC, HG, BPS (social security institution), Health care providers, ASSE (public health provider), HCEN (National Electronic Health Record), Accesa, Quanam, Tryolabs, CUTI (Uruguayan Chamber of Information Technology), Sibel, Abstracta, Qualified, DVelop, I+Dev, Concepto, GeneXus Consulting, Globant, Deaf Health Unit, “Tiraparedes” Health Clinic, BigCheese, InSwitch, IxDA, Dils, ICA, Google, Apple, Facebook, BlazeMeter, Sinch, GeneXus.

Naming individuals would be a never-ending list of people who have contributed their work and ideas, and that's why I simply point to Laura Aguiar as one of those great examples of civic responsibility for this cause. In addition to Laura there are many others, but it would be too long and perhaps unfair to mention just a few in this article.

Ideas

Regarding ideas, there is not much innovation. It turned out to be a combination of ideas from China and South Korea, which have been used to start building the app and were later adapted to Uruguay's reality in record time. Almost all companies had the same ideas about what the solution to the problem we faced would look like; the challenge was how to build it quickly.

- Centralize requests so as to measure risks, enable patient triage, and then distribute and take different types of actions.
- Make it possible to connect the virtual world with the physical world of tests.
- Allow for mass triage and then follow up symptoms remotely.
- Reduce demand for call center services of health care providers.
- Quickly provide some kind of response to the population to address their concerns.

We can say the app is adapted to Uruguay and its health stakeholders. This adaptation includes, among other things, interconnection with all health stakeholders, provision of telemedicine, and design with multi-channel and accessibility in mind.

The official strategy can be accessed in the following link (in Spanish):

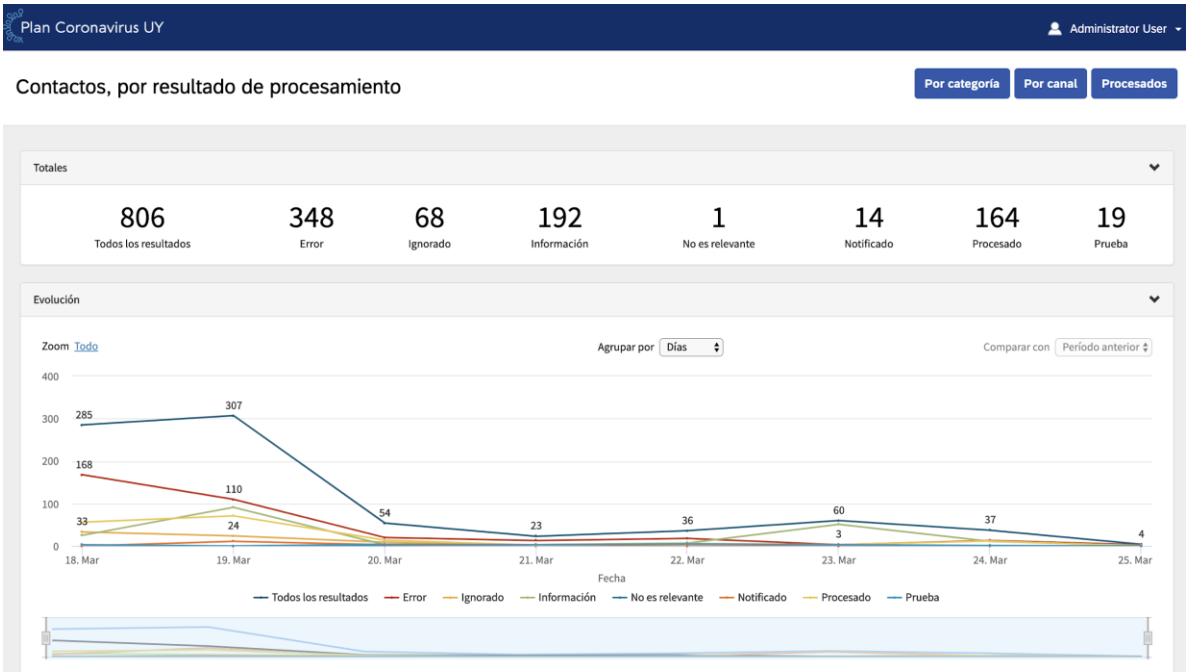
https://www.gub.uy/agencia-gobierno-electronico-sociedad-informacion-conocimiento/comunicacion/noticias/estrategia-digital-frente-covid-19

Tools (and Processes)

As for requests, it was decided that the input queue would be centralized using a multi-channel strategy. Thus, the first stage of information registration was implemented in 7 days through the following channels (the visible part of the project):

- Call centers (Web form)
- Web Chatbot
- Instant Messaging (WhatsApp, Messenger)
- WebApp (Progressive Web Application)
- Native Apps (Android and iOS)

What data is coming in? Of what quality is it? Data quality groups were created to make an initial analysis of this information and thus enter the system.

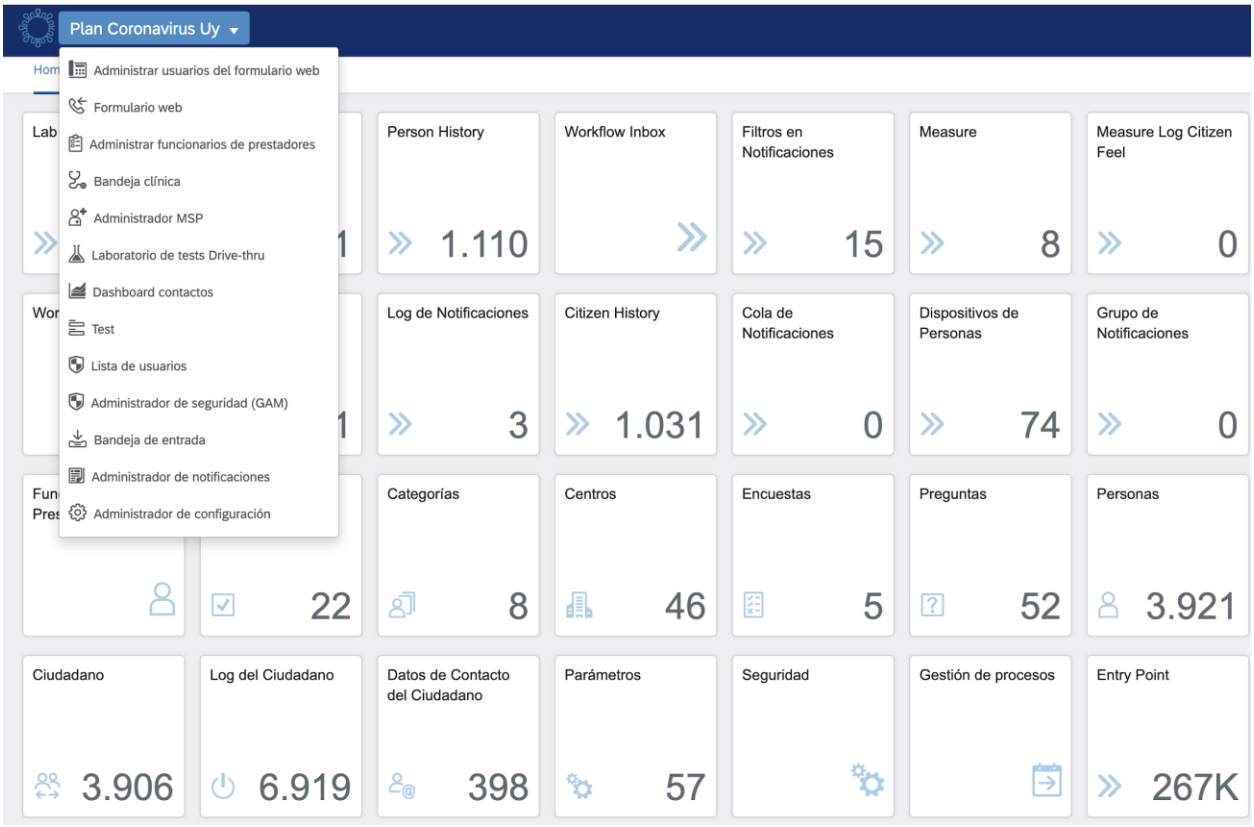


OK, but enter where? The invisible –or less visible to users– part of the Project:

--> A risk monitoring system for COVID-19 or, in the future, for other diseases.

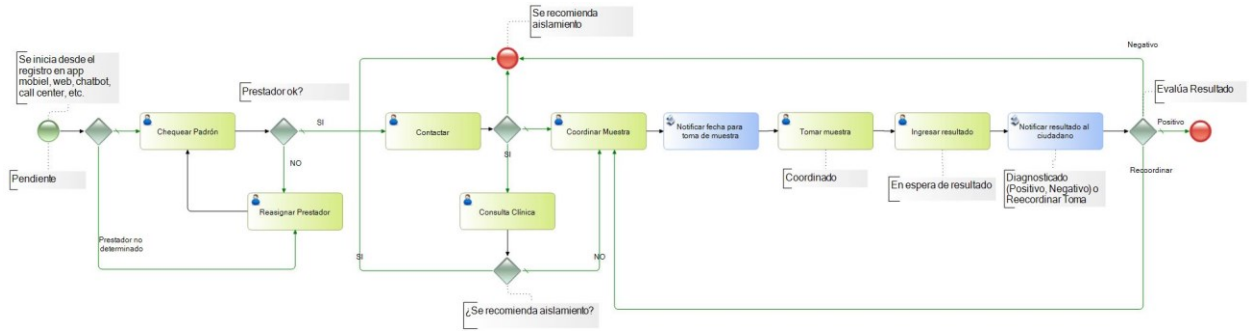
The system, which was developed from scratch, now has more than 80 tables and more than 20 modules, including a risk module and a monitoring module, both of which were put into operation in the second week of work.

Another detail is that this system must have a web interface and decision-making dashboards. Obviously, it must be able to interoperate with all state systems: Ministry of Public Health, National Emergency System, Clinical Records, and more.

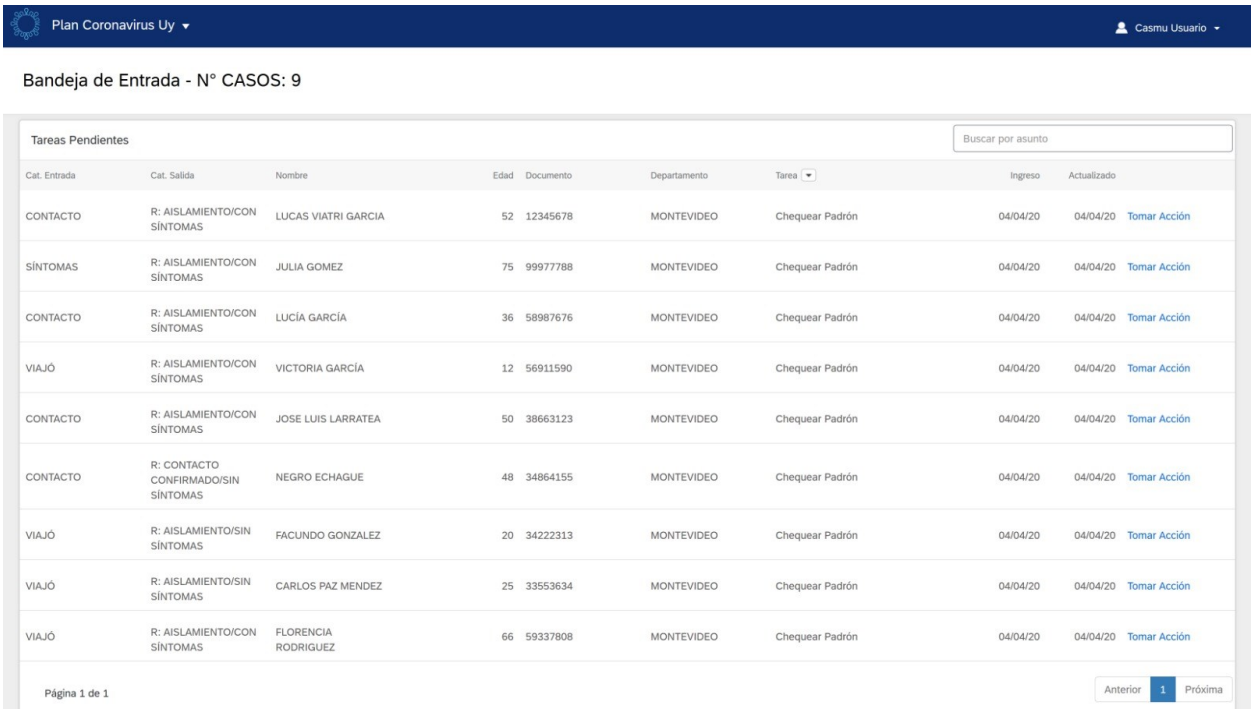


Now, suppose that a user was able to enter the system after the initial quality analysis.

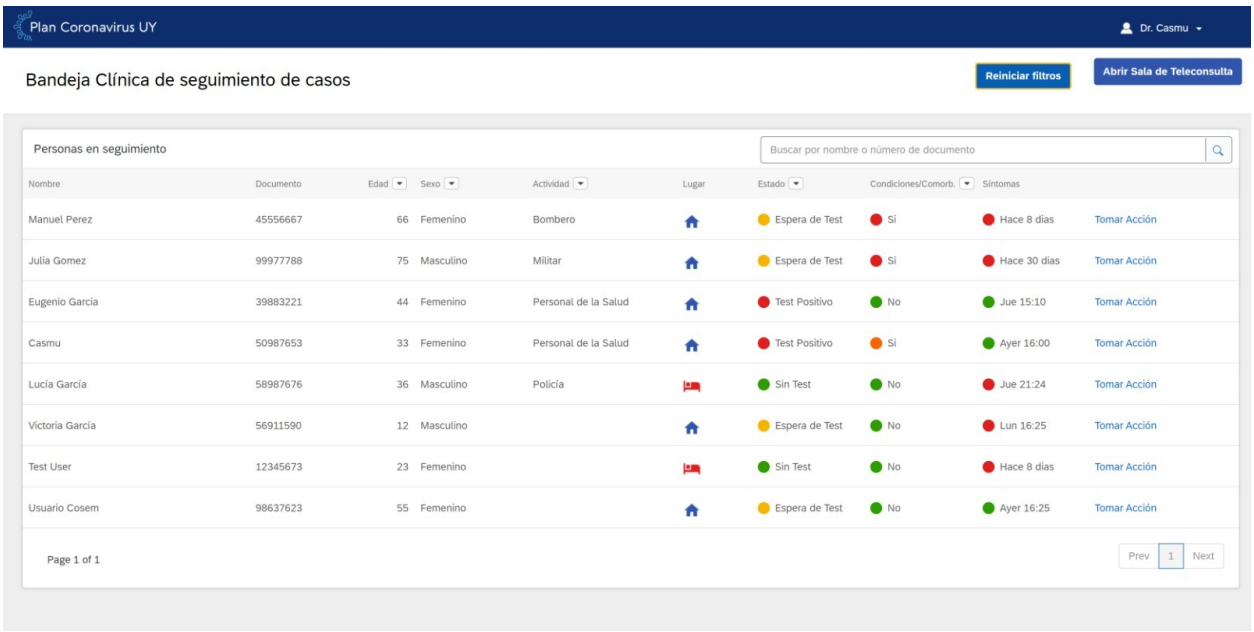
What do we do with this information? This is changing all the time, so what is working in the background is a workflow engine that distributes cases to each health care provider's inbox.



In this inbox, staff from health care providers start the contact workflow and eventually distribute tasks to clinical inboxes handled by physicians.



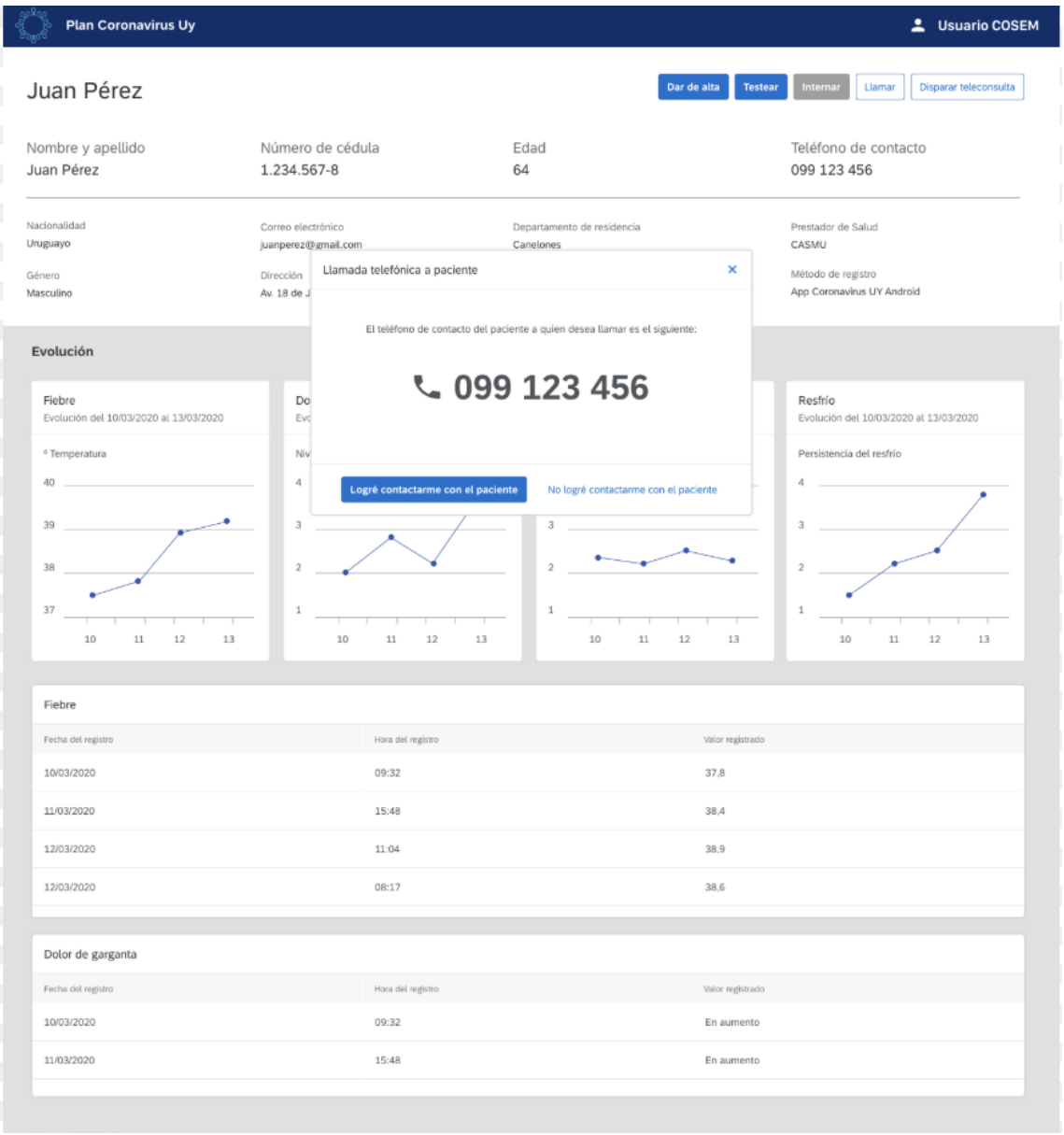
Doctors have their own inbox where users are classified by risk level according to criteria defined by epidemiologists. This inbox is used in a web browser and must be able to work on any Android device, such as those owned by ASSE –the public health provider– so that doctors can use it from any location.

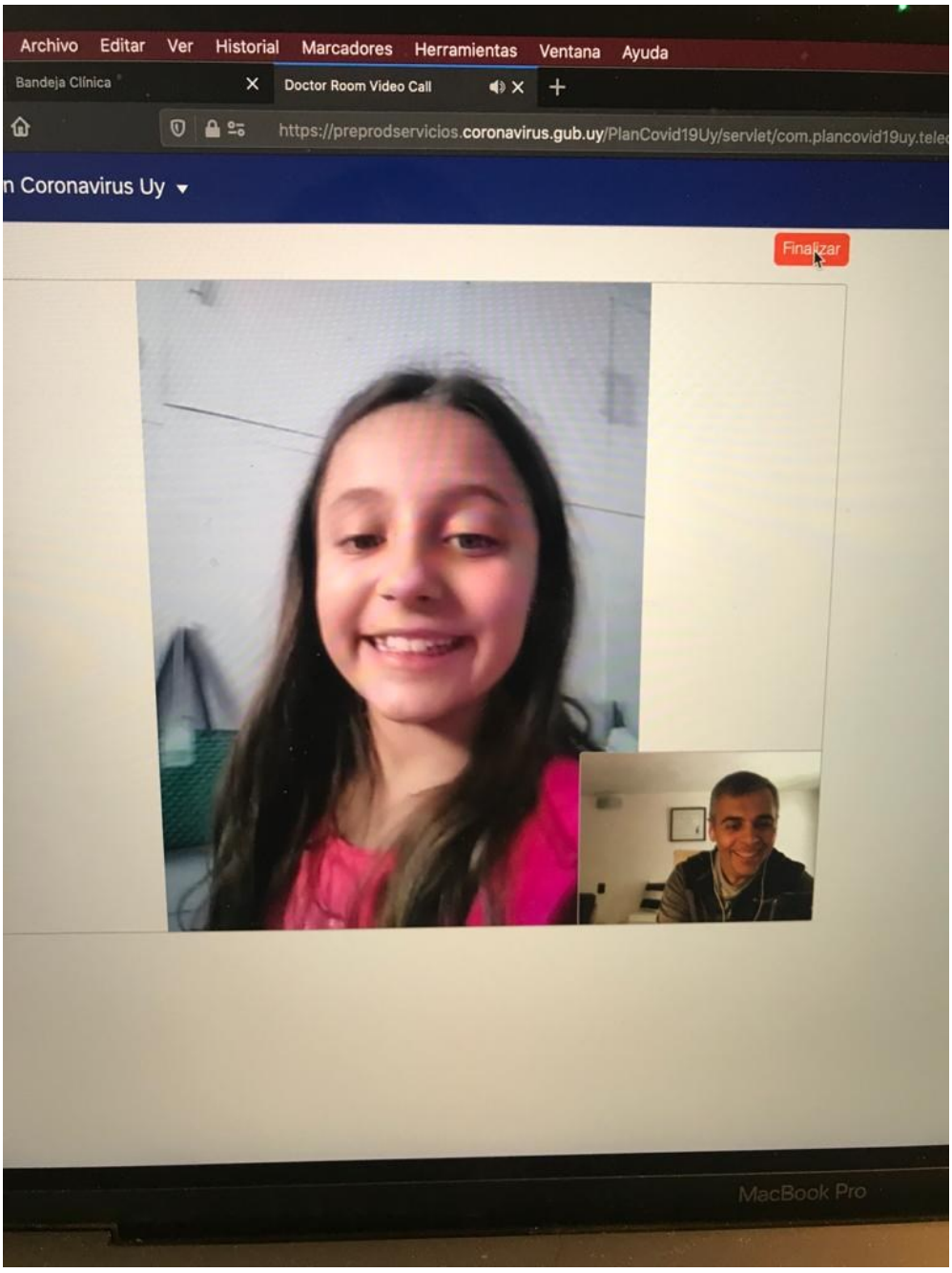


Telemedicine: How do doctors interact with patients?

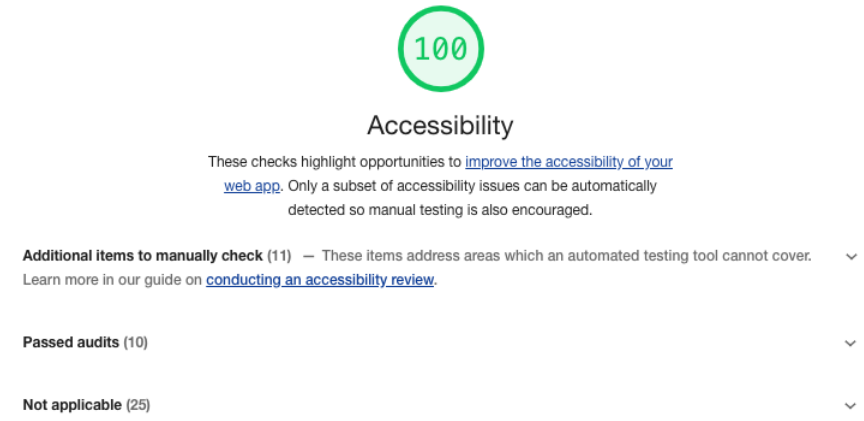
Once again, it's the same concept as for data input: multi-channel.

The idea is that you can interact over the phone or video call (if the conversation was started directly through the app). For patients with hearing impairment, a sign language interpreter service in real-time (DiLS) is being considered as an additional communication option.





Accessibility has always been a priority from a technical point of view. This implies that every new development, such as the web application, is fully accessible. Work is under way to incorporate sign language to make further progress in this area.



What about interaction with the patient?

As in any other consultation, decisions are made by the doctor or health care professional. In other words, the app provides guidance and the health staff decides what to do.

What happens if a test is ordered?

As in the previous cases, the system can manage a queue of tests to be started according to the availability of drive-through testing sites, which connects us to the physical world. This also had to be prototyped and specific modules for that process had to be created in the system.

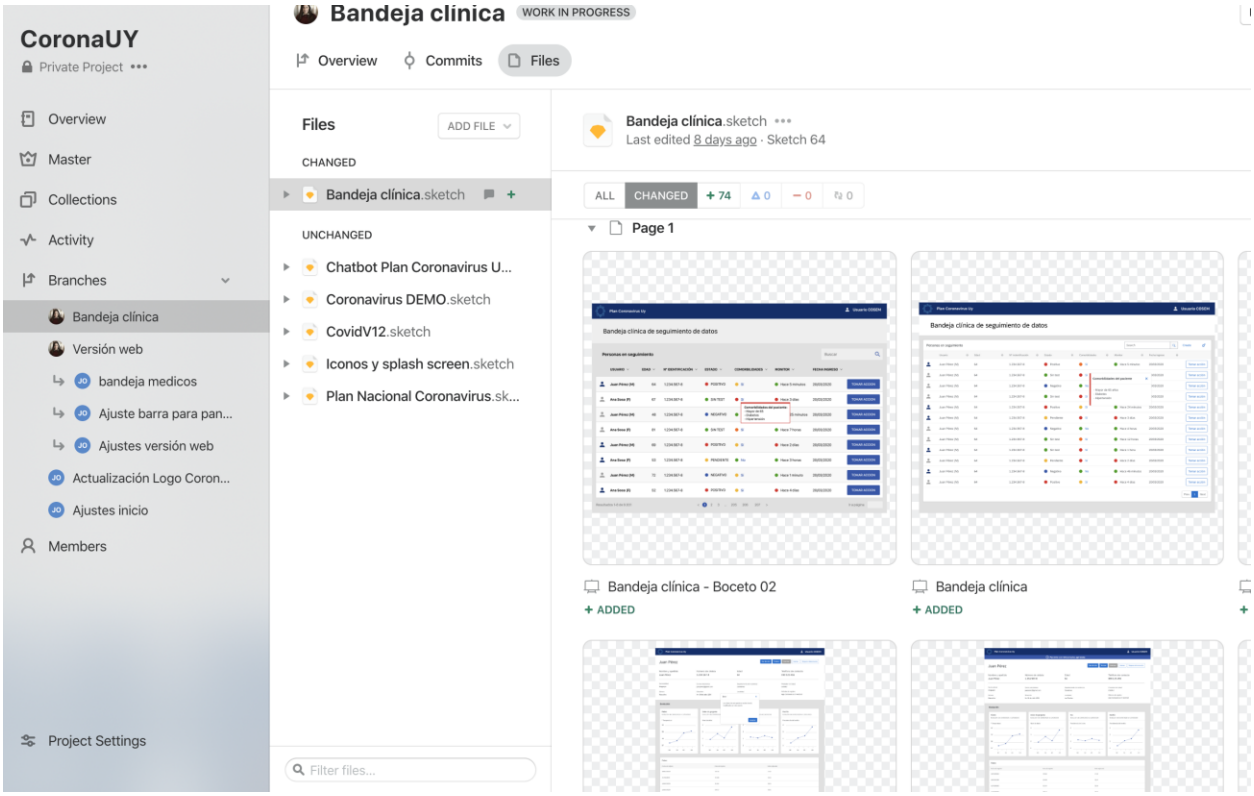
Development process and more

So far, we've followed a functional cycle. What about non-functional aspects? What can be said about the process? What infrastructure is used?

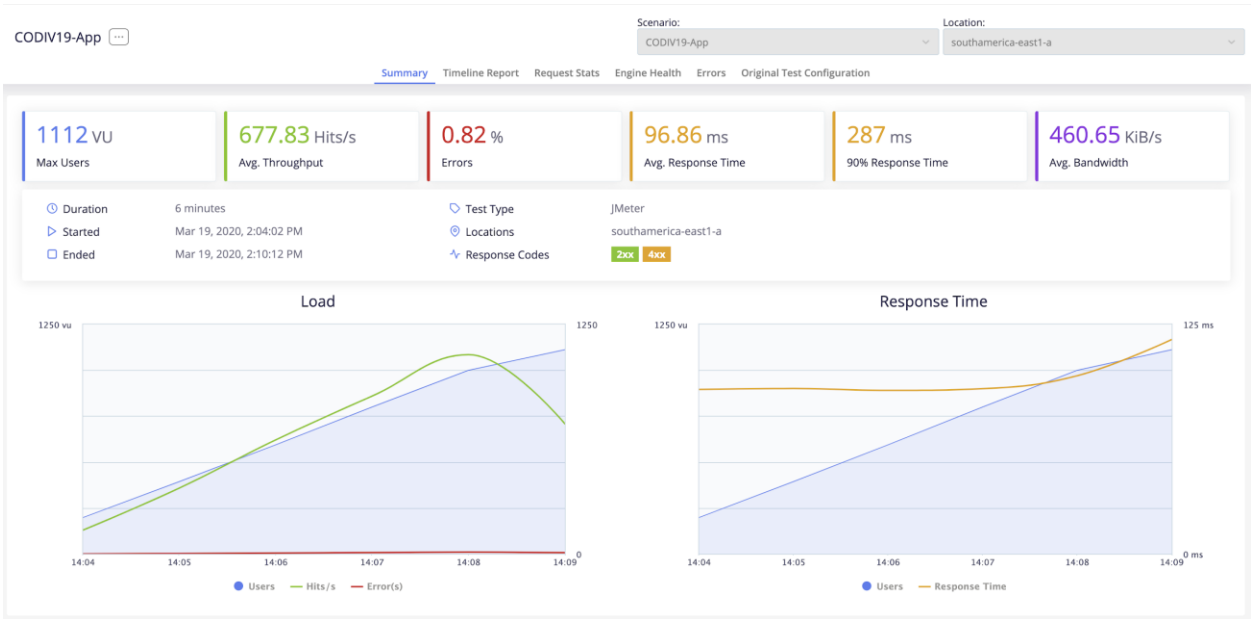
An impressive computer security team is committed to ensuring that the data and the system are secure. Although I may not be the right person to list everything that's been done here, I must say it's amazing: Infrastructure Security, Communications Security, Access Modeling, and System Permissions.

In addition, several UX teams are working on aspects related to design and interactions (Globant, IxDA, GeneXus Consulting, and individual people).

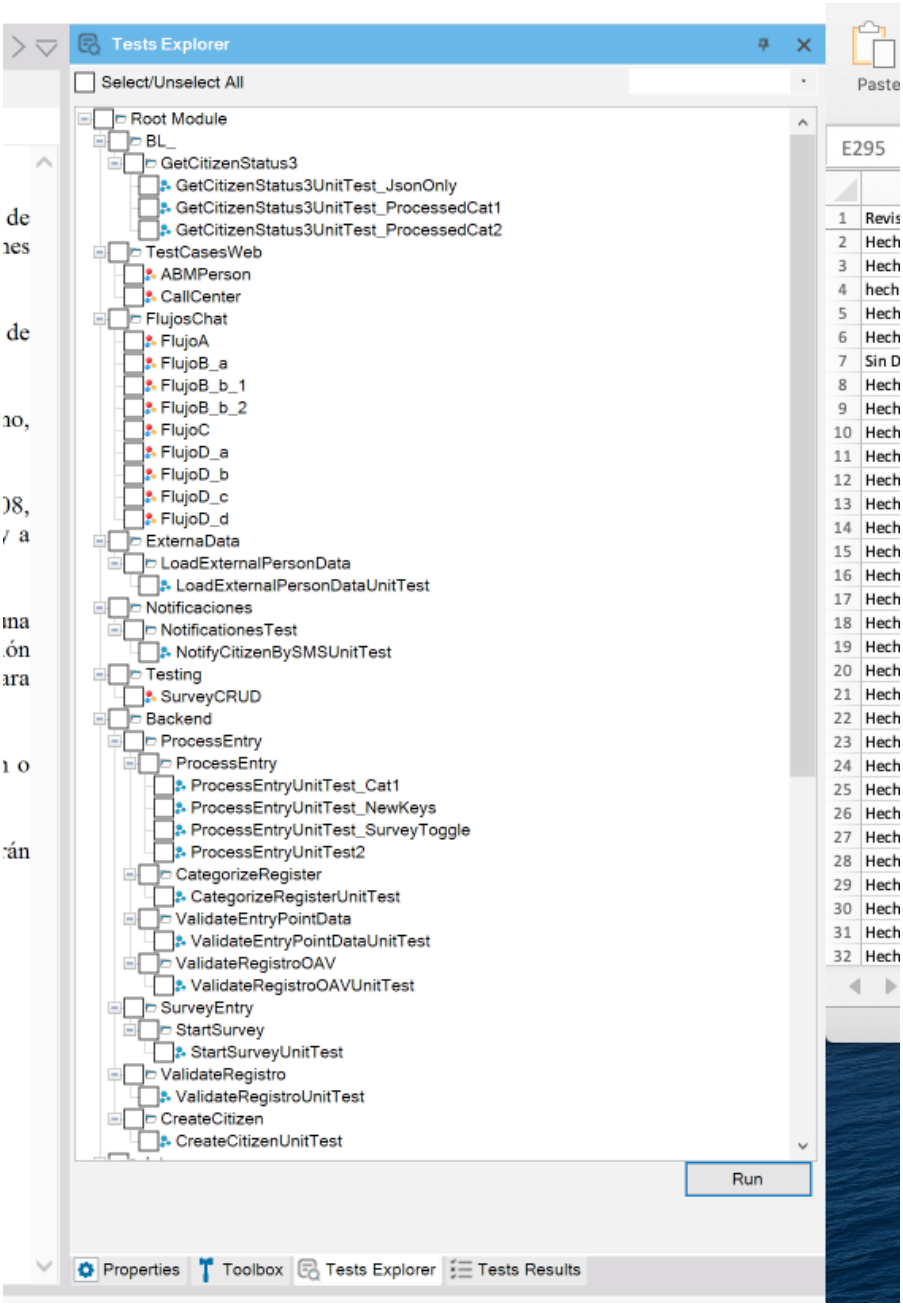
The team worked and iterated in the areas of Information Architecture, Interaction Design, and Visual Design. Various levels of prototype accuracy were achieved at high speed up to the functional prototype in GeneXus.



Performance Tests: the entire team at Abstracta has been fully committed to this task from the beginning. Everything put into production has been tested using BlazeMeter and other tools.



Countless Unit Tests were programmed by different people.



Functional tests were also made and several companies worked in this area: Qualified, Abstracta, Health care providers, Accesa, GeneXus, among other volunteer testers (including my dear wife, Nati!).

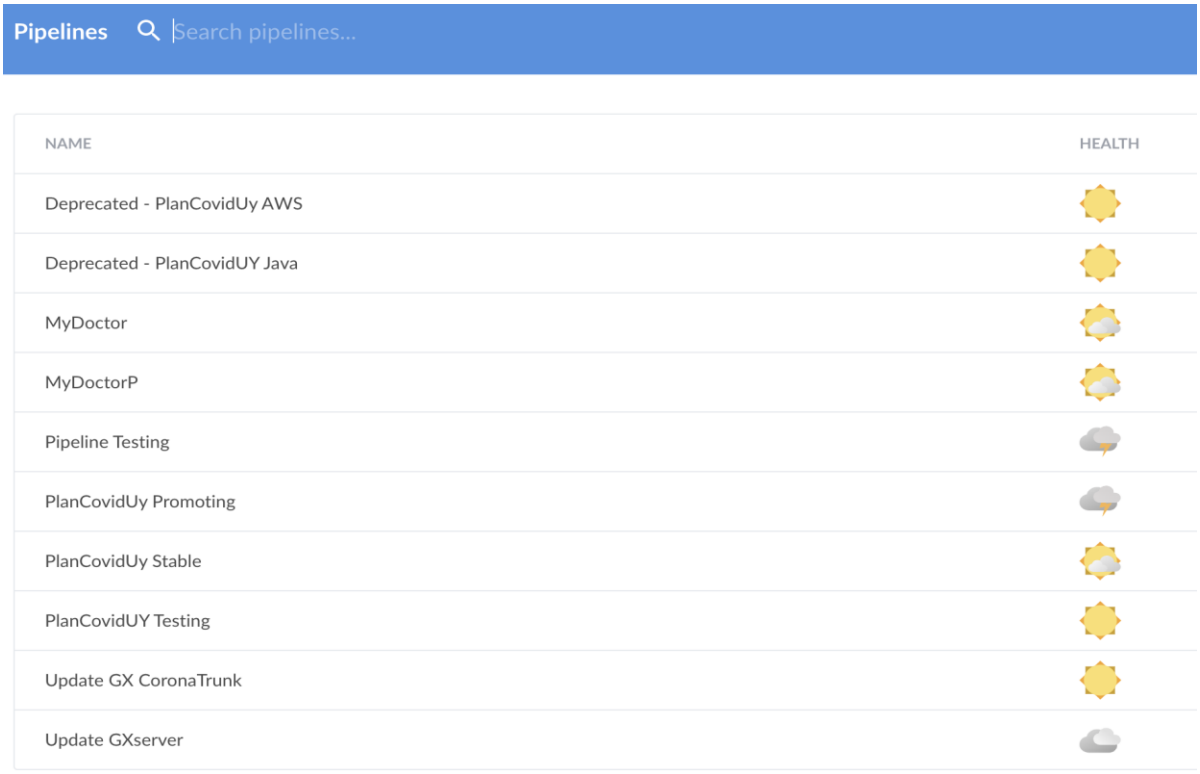
A	B	C	D	E	F	G
		I1	**I2**	**I3**	**I4**	**I5**
Resumen		Usuario sin seguimiento / sin test positivo / App recién instalada	Usuario sin seguimiento / sin test positivo / App YA instalada	Usuario en seguimiento / App recién instalada	Usuario en seguimiento / App YA instalada	Usuario positivo / en seguimiento /App recié instalada
App Instalada	Si		x		x	
	No	x		x		x
Estado paciente	Positivo					x
	En seguimiento			x	x	
	Sin seguimiento	x	x			
Precondición		En el back-end NO se encuentra el registro de esa CI	En el back-end se encuentra el registro de esa CI	En el back-end ya se encuentra el registro de esa CI indicando que está en seguimiento	En el back-end ya se encuentra el registro de esa CI indicando que está en seguimiento	En el back-end ya se encuentra el registro de e CI indicando que es posi
Resultado esperado		Igual que la v1. En ningún lugar debe pedir código de acceso	Igual que la v1. En ningún lugar debe aparecer un login	Usuario debe ingresar sus datos, y luego debe pedir código de acceso	En Home ve que está en seguimiento. En Mi Estado debe pedir código de acceso	Usuario en Home ve opciones y debe registr sus datos. Luego debe pedir código de acces
		STOPPER	**STOPPER**		**STOPPER**	

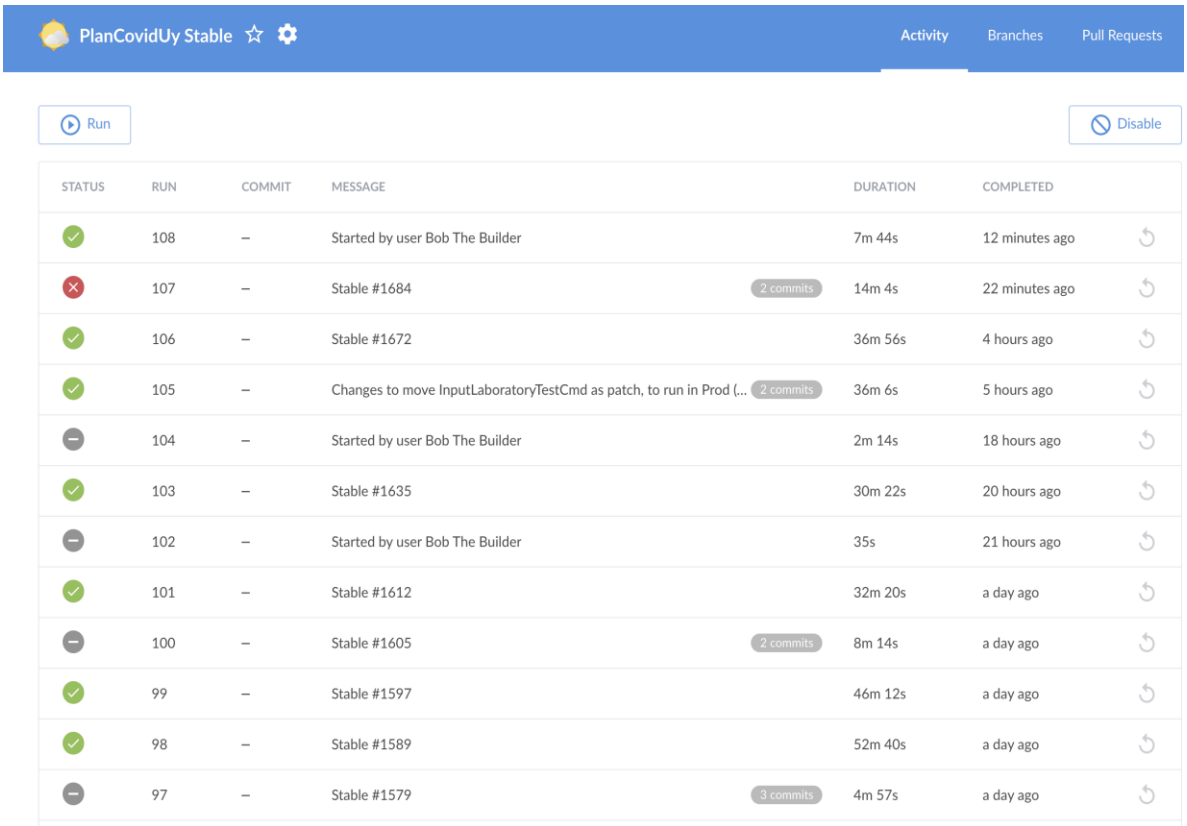
What about the development cycle?

The security team monitored the app's secure development. A great team of continuous integration currently includes 5 pipelines, trunk, testing, AWS testing, pre-prod ANTEL, prod ANTEL.

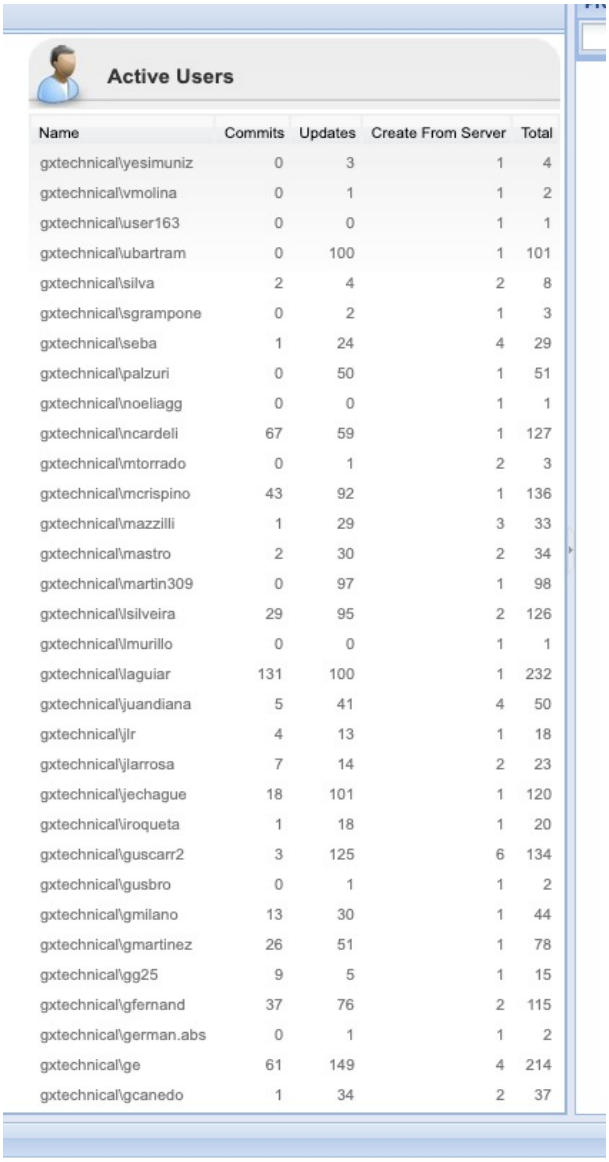
For ANTEL environments in particular, automation tools were created: deployment to various WebApps, patches, process execution, reorganizations, queries, etc. Even if we're still far from AWS, a first step has been taken.


...-accesos02:/var/gx — ssh ◂ msp-access.sh
...msp-accesos02:~ — ssh ◂ msp-access.sh
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
P R E - P R O D U C T I O N
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
1. Deploy Process Server Only
2. Deploy All Servers
reorg_pre. Execute Rerogs
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
P R O D U C T I O N
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
3. Deploy Process Server
4. Deploy All Servers
5. Restore last deploy Process only
6. Restore last deploy all
~~~~~~
R E O R G S
~~~~~~
9. Send Reorgs to servers (no execution here)
10. Execute Rerog in Pre-Prod
11. Execute Reorg in Production
7. Exit
Enter choice [1 - 7] 7
[root@msp-accesos02 gx]#


Pipelines
Search pipelines...
NAME
HEALTH
Deprecated - PlanCovidUy AWS
Deprecated - PlanCovidUY Java
MyDoctor
MyDoctorP
Pipeline Testing
PlanCovidUy Promoting
PlanCovidUy Stable
PlanCovidUY Testing
Update GX CoronaTrunk
Update GXserver

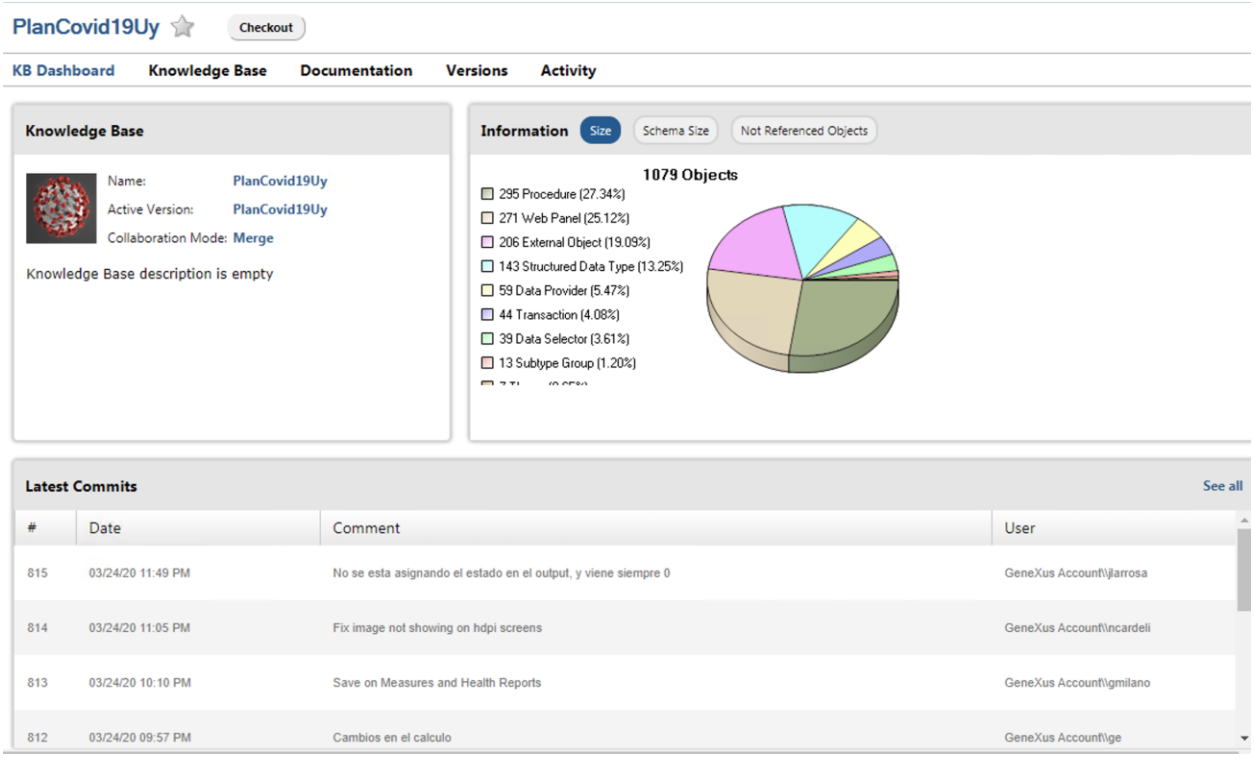

PlanCovidUy Stable
Activity
Branches
Pull Requests
Run
Disable
STATUS
RUN
COMMIT
MESSAGE
DURATION
COMPLETED
108 – Started by user Bob The Builder 7m 44s 12 minutes ago
107 – Stable #1684 2 commits 14m 4s 22 minutes ago
106 – Stable #1672 36m 56s 4 hours ago
105 – Changes to move InputLaboratoryTestCmd as patch, to run in Prod (... 2 commits 36m 6s 5 hours ago
104 – Started by user Bob The Builder 2m 14s 18 hours ago
103 – Stable #1635 30m 22s 20 hours ago
102 – Started by user Bob The Builder 35s 21 hours ago
101 – Stable #1612 32m 20s a day ago
100 – Stable #1605 2 commits 8m 14s a day ago
99 – Stable #1597 46m 12s a day ago
98 – Stable #1589 52m 40s a day ago
97 – Stable #1579 3 commits 4m 57s a day ago

The development of the system's core involved 42 people with more than 2,000 commits to date, in 3 weeks of development work.



Active Users

Name	Commits	Updates	Create From Server	Total
gxtechnical\yesimuniz	0	3	1	4
gxtechnical\vmolina	0	1	1	2
gxtechnical\user163	0	0	1	1
gxtechnical\ubartram	0	100	1	101
gxtechnical\silva	2	4	2	8
gxtechnical\sgrampone	0	2	1	3
gxtechnical\seba	1	24	4	29
gxtechnical\palzuri	0	50	1	51
gxtechnical\noeliagg	0	0	1	1
gxtechnical\ncardeli	67	59	1	127
gxtechnical\mtorrado	0	1	2	3
gxtechnical\mcrispino	43	92	1	136
gxtechnical\mazzilli	1	29	3	33
gxtechnical\mastro	2	30	2	34
gxtechnical\martin309	0	97	1	98
gxtechnical\lsilveira	29	95	2	126
gxtechnical\lmurillo	0	0	1	1
gxtechnical\laguiar	131	100	1	232
gxtechnical\juandiana	5	41	4	50
gxtechnical\jlr	4	13	1	18
gxtechnical\jlarrosa	7	14	2	23
gxtechnical\jechague	18	101	1	120
gxtechnical\iroqueta	1	18	1	20
gxtechnical\guscarr2	3	125	6	134
gxtechnical\gusbro	0	1	1	2
gxtechnical\gmilano	13	30	1	44
gxtechnical\gmartinez	26	51	1	78
gxtechnical\gg25	9	5	1	15
gxtechnical\gfernand	37	76	2	115
gxtechnical\german.abs	0	1	1	2
gxtechnical\ge	61	149	4	214
gxtechnical\gcanedo	1	34	2	37



Let me also mention those who have collaborated with this project, from giving words of encouragement or advice, to acts of kindness such as taking a monitor to your home or sending you something in an Uber. It has all added up and will continue to do so.

In addition, I want to thank all our families who have helped in the background by putting up with us working nonstop for more than 15 days.

This is the Coronavirus UY app.

Nicolás Jodal, who is introducing it in the media (on behalf of the private sector), has said that 150 people were involved in the project, which may seem a lot for an app. It seems like a lot, because at first we only see the app, but behind it there are complex requirements and systems interacting. To achieve this, many people had to work together ;)

If someone tells you that the app consists of 3 screens, it means that we have met the objective of hiding its complexity. If anyone has received a call, has been tested, or is being followed up thanks to the app, we will have achieved our real goal which is for technology to do its bit to help in this war.

To me, deep down, when someone talks about the app, they're talking about: People, Ideas, and Things… In that order!

Here are some backstage moments of this creation, where obviously everyone worked from home. One app, a thousand stories, a thousand laughs, a thousand discussions, and a single

goal. Today, in Uruguay’s technical community we have more mutual respect for and confidence in each other than ever before.