



CONSERVE
URBAN RESILIENCE





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Introducing CONSERVE

CONSERVE – or Contingency Operations for Strategic infrastructure and the Vulnerable – is an innovative integrated approach to urban resilience planning, event management, environmental management and critical infrastructure protection. It focuses on inter-agency operability during times of crisis.

Our proof-of-concept uses flooding as an example of a recurring disaster that typically involves multiple agencies in stemming its impact.

A recurring issue

Serious flooding is an all-too-regular occurrence in the UK, with the cost of damages stretching into the billions of pounds – not to mention the serious emotional strain for those whose homes and businesses are affected.

Floods in 2012 saw hundreds of people forced from their homes, landslides blocked railways, high-profile rural events cancelled, and at least nine deaths.

December 2015 – the UK’s wettest month in more than a century – brought similar havoc, with the cost of damage to property alone being estimated at £1.5 billion.

It’s a problem that isn’t going away, and one that will continue to be faced down by national and regional agencies and emergency services.

And while water can often get the better of technology (ever had to put your phone in a bowl of rice overnight?) with CONSERVE we’re aiming to prove how it can be used to support these agencies as they respond to burst banks around the country.

Making problems easier to share

One of the main difficulties faced when responding to floods is that the various organisations involved in the relief effort are often brought together in an ad hoc way. They form a resilience forum, generally headed by the blue light services, and are tasked with intervening and mitigating the emergency situation.

The problem that dogs all such committees is they don’t have a separate budget, which means they don’t have any dedicated IT infrastructure to connect each individual agency’s infrastructure.



Surveying the scale of the threat

Rather than attempting to solve this problem head on, CONSERVE aims to circumvent it – providing a solution that increases the situational awareness of a multi-body committee, while taking into account the possibility that the group as a whole may not have any dedicated IT infrastructure.

The CONSERVE test bed is in Glasgow.

In the event of serious flooding in the area, a combination of ‘Category 1 Responders’ from Police Scotland, the Scottish Environment Protection Agency, NHS Scotland, the Convention of Scottish Local Authorities, the Scottish Fire and Rescue Service, the Scottish Ambulance Service, British Transport Police, and the Maritime & Coastguard Agency – as well as ‘Category 2 Responders’ from the likes of

the Met Office, Network Rail, Scottish Water and others – will work together to quell the issue.

As individual agencies, these responders will all have their own infrastructures and computer models that they use to monitor ground saturation, river levels, engineer resourcing and so on, depending on their area of expertise.

The aim of CONSERVE is not to replace any of those existing models or infrastructures, but rather to allow all the agencies involved to securely share their data with one another to smoothen the collaborative effort.

Saving time to save lives - securely

In an emergency situation, time is critical and being able to pool and parse huge amounts of data quickly and accurately is a potentially life-saving capability.

What CONSERVE allows you to do, from an operational and tactical point of view, is see in real time where all your assets are – fire engines, ambulances, volunteer networks – as well as the data that comes in from monitoring stations and even social media posts from concerned citizens.

It’s an instant, real time snapshot of what’s actually happening on the ground.

£1.5bn

The cost of damage to property in December 2015 – the wettest month of this century.

The data virtualisation tool at the heart of CONSERVE means everyone involved in the response effort can access a panoramic view of the situation, and make workflow and resourcing decisions based on that information – rather than just data that’s siloed off from the rest of the committee.

Of course, there’s a privacy aspect to bear in mind too. Different organisations will understandably have different regulations or preferences with regards to what information they share with others.

The CONSERVE platform takes that into account, giving operatives control over what’s shared and what isn’t. The platform also removes the need for data to be cached at a

third party site, minimising any longer term data security concerns.

More than just flooding

Of course, flooding is just one of the many disaster situations our emergency services and public agencies are called on to attend.

CONSERVE, as a proof-of-concept, is being developed with a degree of flexibility in mind that will allow the tool to be applied to any number of other emergencies.

That could be heavy snowfall, terrorist attacks, droughts or earthquakes – anything with lots of moving parts and involving multiple agencies in the response effort.

That’s why CONSERVE is designed to be a lightweight, software-based solution that offers the greatest flexibility to anyone wishing to use it.

It ties together existing IT infrastructures, data monitoring, mobile applications and manpower to provide greater situational awareness, enhanced position reports and, ultimately, a quicker, more effective response to any given situation.

**ROAD
CLOSED**

Flood



How CONSERVE benefits you

The organisation of response and recovery activities in a natural disaster or major disruptive event is complex. The CONSERVE platform enables those responsible to:

- Gain a clearer view
- React more quickly
- Limit damage
- Improve resourcing in complex and time-critical scenarios
- Train for future events

Let's go into each of those in a bit more detail and explore why they matter...

Gain a clearer view

Arguably the biggest challenge for anyone responsible for dealing with a disastrous event is a lack of visibility over the complexity of the situation.

Among the chaos and confusion, how do you know where affected people are? How do you know which emergency services are needed and where? How far has the disaster spread and where is it headed next?

By having all that information in one place, in real time, you instantly have a very clear and detailed picture of events to make informed decisions about. Let's take vulnerable people in a flood as an example.

It's the same tragic story every time a flood occurs: a disproportionate number of vulnerable people are among the casualties – elderly, infirm or otherwise – and unable to escape from the water without assistance.

If emergency services can immediately see where those people are, they can prioritise helping those least able to help themselves and

send the necessary services to get them out before the water reaches them.

React more quickly

Following on from the above points, perhaps the most important thing for emergency services in any situation is speed. And the speed at which they react to a disaster has an enormous impact on the extent of the damage it causes.

“By having all that information in one place, in real time, you instantly have a very clear and detailed picture of events to make informed decisions about”

Let's use flooding as an example again – if a river bursts its banks somewhere out in the wilderness, you are relying on somebody seeing and reporting it. But their ability to report it will ultimately determine how quickly emergency services can react and mitigate any potential damage.

Using CONSERVE dramatically speeds up that process by giving people an app through which they can easily log any incidents.

So even if the river is bursting its banks in multiple places, anyone who sees that can immediately report it. This means emergency services effectively get an early warning that something significant is happening, enabling them to take action before the danger escalates.

And by having information about all emergency services and events in one place, in real time, your decisions about the best course of action become more rapid. You don't have to spend time hunting down the facts – everything you need is in front of you.

Limit damage

Increasing awareness and visibility of the situation and being able to react quicker means emergency services can mitigate much of the harm caused by a disaster before it occurs.

That's not to say CONSERVE can physically stop that disaster in its tracks – far from it. But by moving vulnerable people out of a flood's path before it reaches them, for example, and buying the emergency services some more time, CONSERVE can certainly give you a head-start on any crisis.

This means less damage to property (if you have early information about a flood you can move to clear vehicles from its path) but, most importantly, less physical and emotional harm to the community.

Improve resourcing in complex and time-critical scenarios

Just as CONSERVE has the power to save time, it can also help enhance the efficiency of allocating resources.

Vast amounts of information normally emerge in a short period of time during emergencies, and that requires responders to take immediate action. However, the complexity of the interdependencies between the emergency actions requires responders to communicate with each other accurately and to allocate resource appropriately.

By receiving detailed information through CONSERVE about an event in real time, responders can see exactly which emergency services are required and how they are dependent on each other.

It also indicates the resource commitment at various locations at different points in time, so that the top commanders and operational and tactical responders can always keep themselves updated of the progress being made.

In other words, you don't need to keep enquiring about where emergency services have been deployed because this information is already automatically being shown on your screen.

When people and time are already stretched during a crisis, this efficiency element is crucially important.

It means you can make the most of the limited resources you do have.

As for the technology itself, because it's mostly software-based and requires no major investment in hardware, it's a relatively low-cost and flexible solution.

Train for the future

Finally, CONSERVE can be used to facilitate training to help improve the way emergency services deal with disasters in future.

The platform logs and timestamps actions during an event, and emergency services or any other stakeholders can look at that data retrospectively and use it for training purposes.

There's a huge amount you can learn from that kind of information: where emergency services

weren't deployed quickly enough, for example, or where they could have been allocated to different tasks or locations more effectively.

It also allows you to study the events leading up to a disaster, so you can learn how to react even earlier and more efficiently before things escalate.

“When people and time are already stretched during a crisis, this efficiency element is crucially important.”

Under the hood

There's very little hardware involved in the CONSERVE system – instead, it uses software to make the most of existing IT infrastructure and devices without the need for significant financial investment.

From a technical standpoint, there are four key areas to consider:

- Secure sharing within the data virtualisation platform
- The data virtualisation platform itself
- The situational awareness and workflow platform
- Mobile apps for community engagement and empowerment

Let's explore each of those elements in detail...

Secure sharing within the data virtualisation platform

One of the biggest challenges with CONSERVE is persuading the various agencies from which we need data that it's safe for them to contribute.

The way we collect and manage data is completely secure for all those involved.

We supply each stakeholder with virtualisation software that they install in their own datacentre. They can then configure what data the platform is able to access – it connects to their databases and collects only those specific data sets, and then the stakeholder configures the link between the virtualisation software and the CONSERVE central platform.

So effectively each data source is giving you exactly what you need and nothing more, rather than opening up their whole datacentre.

They control not only what the central platform connects to but what data it can access when it does connect to something, limiting their risk while still allowing them to provide a great public service.

Most importantly, however, the data shared with CONSERVE is never copied or permanently stored anywhere. It is only accessed temporarily to serve the required purpose.

So there is no chance of that data being compromised after the event.

The data virtualisation platform itself

The virtualisation platform sits at the core of CONSERVE. It is the hub that allows the various agencies involved in overcoming a crisis – from police to medics and everything in between – to securely share their data.

That data flows into the virtualisation platform in whichever format individual agencies choose to present it. The platform takes all of that data from various different sources and presents to emergency services or other responders.

Formatting data from multiple sources (of frankly varying quality) in a way that makes sense to people can be more than a little challenging.

To overcome that, the CONSERVE platform accesses data in two ways:

- From publicly-held datasets
- From private data centres (that choose to provide specific data)

This means the platform can bring together previously disparate sets of data and create a single, useful stream of information.

Let's say you need detailed information about a river during a flood – you might ask the platform to pull in data about river levels, ground saturation and the weather forecasts. That information could come from various different places, but the platform will pull it from public and private sources, blend it together, and present you with a single data

set that you can use to make an informed decision.

The platform isn't creating any additional data – it collects existing data from multiple sources, manipulates it, and gives it to you in an intelligible format.

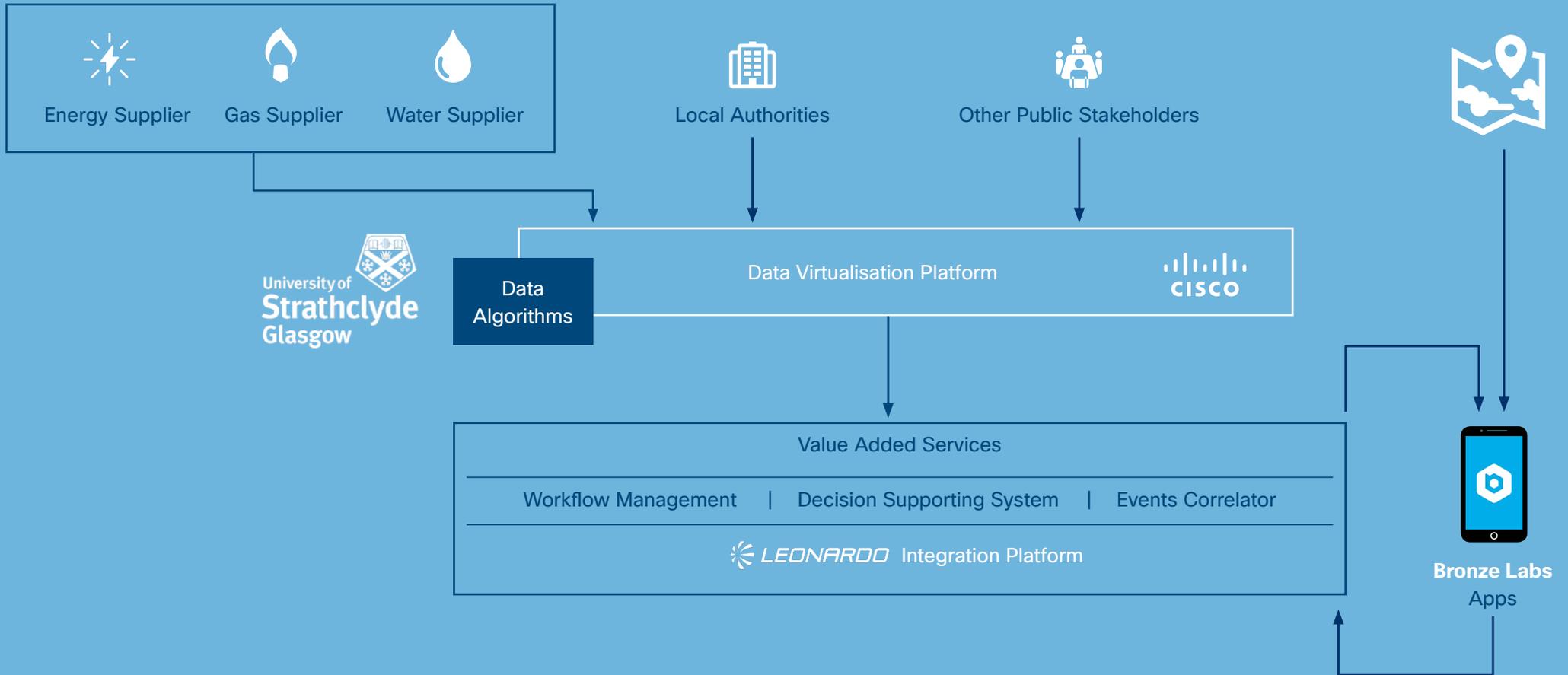
And all of this happens in real time.

The situational awareness and workflow platform

The platform directly supports operators in safety and security management during crisis and emergency situations.

It effectively provides an environment to integrate and correlate event reports coming in from underlying or external systems, such

CONSERVE Logical Architecture



as the data virtualisation platform or the mobile apps, each of which is devoted to managing a specific vertical problem.

This approach is made possible by the normalisation of the events according to an abstract and agnostic model, and allows operators to compare information on systems that are not naturally correlated, thus generating information not otherwise available.

CONSERVE's secure city platform allows us to:

- Provide a unique sight into the monitored area and a common emergency management procedure, regardless of the vertical subsystems involved.
- Create value-added information not available

within the single subsystem but generated by the correlation of information from different subsystems.

- Crystallise the complexity of the interdependencies between the emergency actions and responders.

Mobile apps for community engagement and empowerment

To enable communication between those overseeing a disaster and people out on the field – whether they're witnesses to the event or those trying to help fix – we've created two mobile apps:

- One app for community engagement
- One for emergency services/first responders

Both apps connect to a cloud-based portal that can push and receive data, allowing for quick and easy communication wherever the user happens to be.

The community engagement app enables citizens to report problems using their mobile device. They can drop a pin onto the app's map when they see an incident, which immediately provides GPS coordinates to the central platform.

The user can also input what is happening – i.e. a flood – and that information will all be passed on to the central system along with their location.

We are effectively turning people into mobile IoT sensors.

But communication works both ways - the community engagement app also allows you to send updates to citizens via the CONSERVE platform. Using data capture, you can send an instant alert to a specific group of people - those in an area where new disruption has happened, for example.

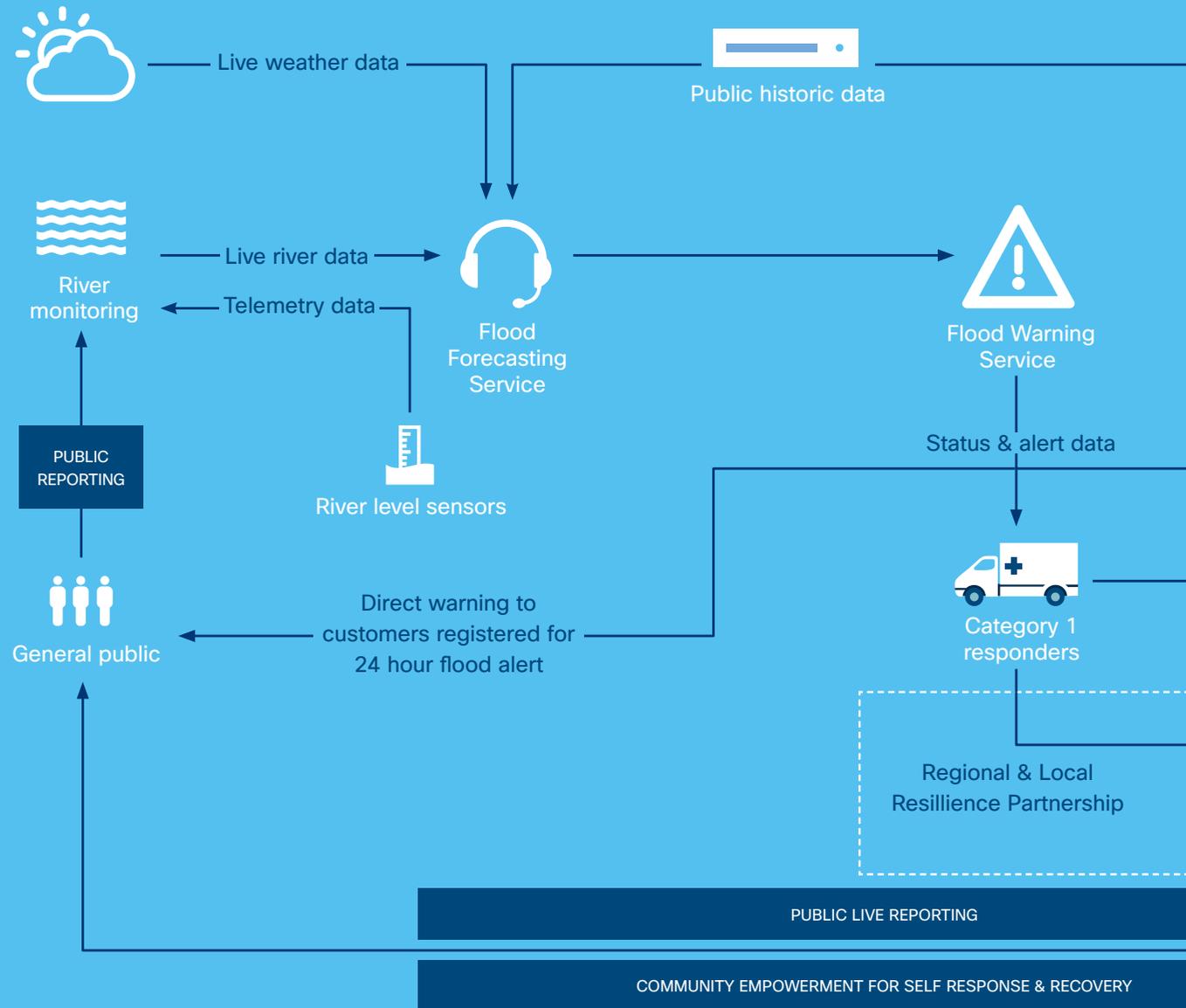
The first responder app works using similar technology to the community engagement one, but instead of simply sending alerts it provides workers out on the field with specific tasks using data capture form. And it can do that within minutes.

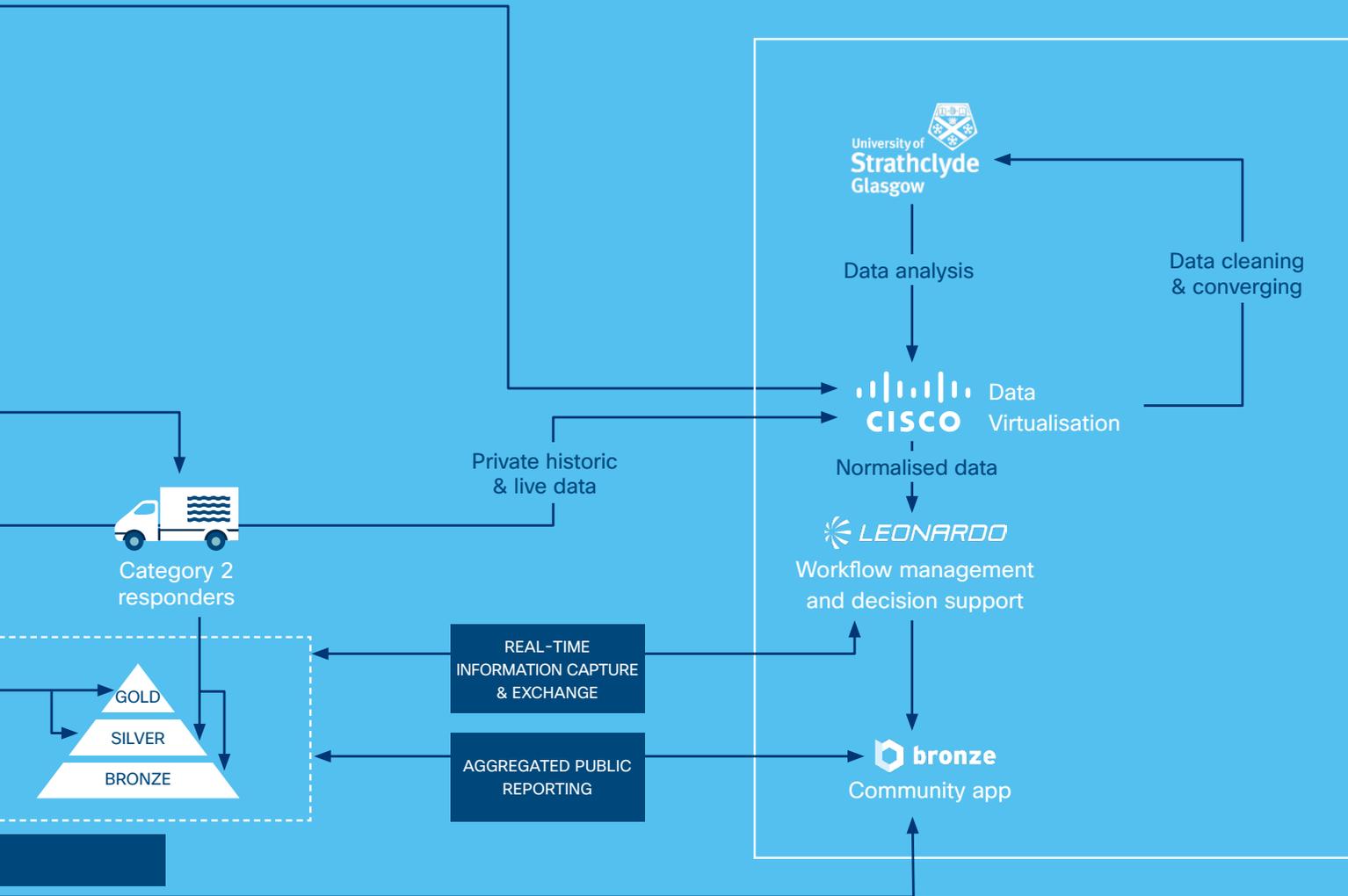
Those responders carry out the tasks and then mark them as completed on the app, which sends that data back to the central portal and instigates further workflows.

The app also provides responders with a tactical map, which takes in data from various sources - ground saturation levels, for example, or locations of burst banks or schools or hospitals - and displays those key points so emergency services can easily navigate to them.

Crucially, however, the responder app allows people to send and receive alerts in simple text message form if no 3G data signal is available. This means communication will usually be possible in even the most remote areas.

CONSERVE Ecosystem







Who's involved?

CONSERVE is being driven by a consortium of four complementary partners, each fulfilling different roles to deliver the solution.



Cisco is a global connectivity hardware, software and service provider. The company is at the forefront of connecting IoT with people, process and data.

As project lead, the team at Cisco is responsible for delivering CONSERVE and providing business cases to support the initiative going forward. The data virtualisation platform will also be provided by Cisco, as well as the system design and reference architecture.



Leonardo is a global high-tech company specialising in aerospace, defence and security with a history of producing automated and highly robust sustainable solutions.

Within the project, Leonardo provides CONSERVE's situation awareness and emergency coordination platform, providing visualisation of resources, workflows and maps.



University of Strathclyde is a public research university located in Glasgow and a member of the Rockefeller 100 Resilient Cities partnership.

On this project, the University is looking after data aggregation of public and private data and providing analytics of historical and real-time data.



Bronze Labs is a UK-based software firm specialising in IoT application development and offering scalable, real-time solutions for organisations aggregating large datasets across the Internet of Things and smart cities.

Bronze Labs is responsible for the community empowerment aspects of CONSERVE, which includes developing smartphone applications and processing large datasets from mobile devices.



