CERN x EARTHQUAKES

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Athens

7 SEPTEMBER 1999

◎ 6.0

$4.2 bn
total damages

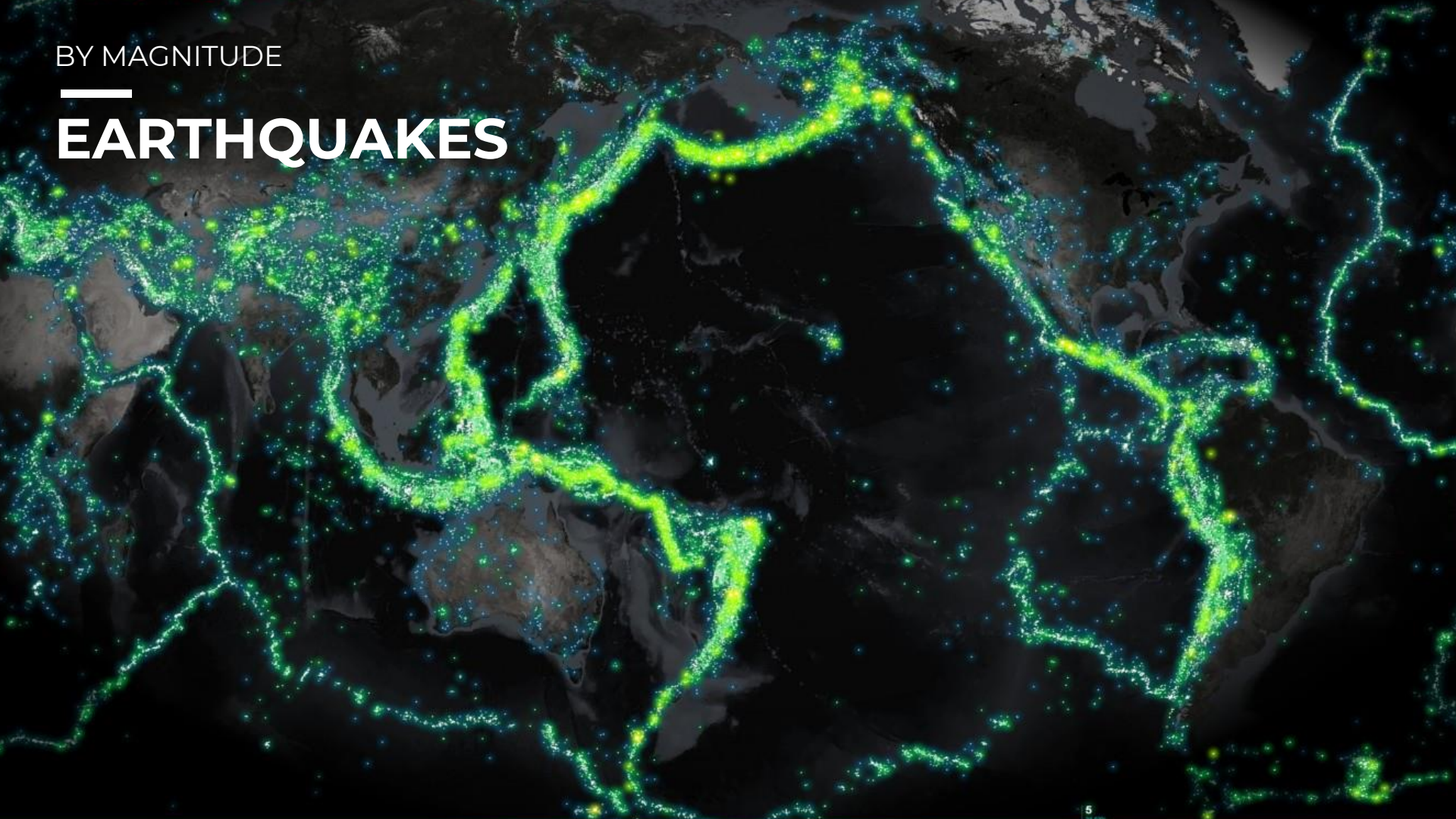
143
deaths

1,400
injured

50,000
homeless

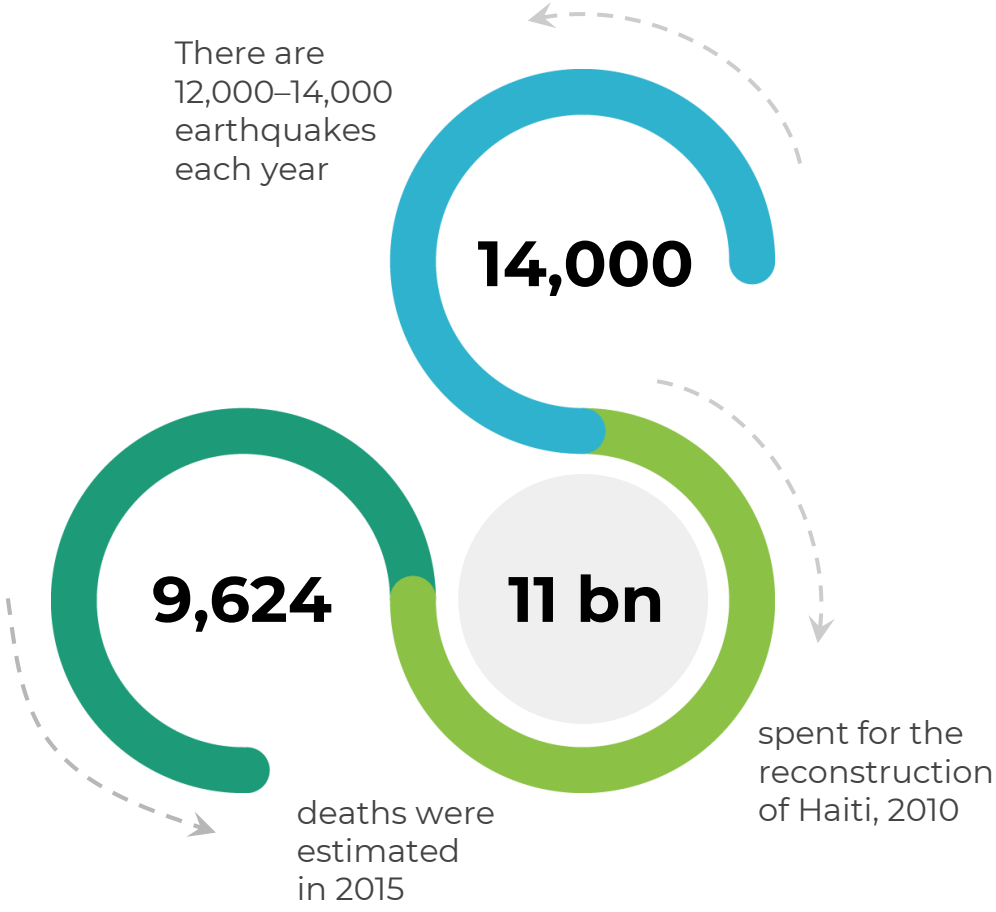
BY MAGNITUDE

EARTHQUAKES



INSIGHTS

EARTHQUAKES IN NUMBERS



"Earthquakes don't kill people, buildings do".

This quote is from Seismologists who believes that human construction and buildings crashing down during earthquakes, are the cause of most deaths.

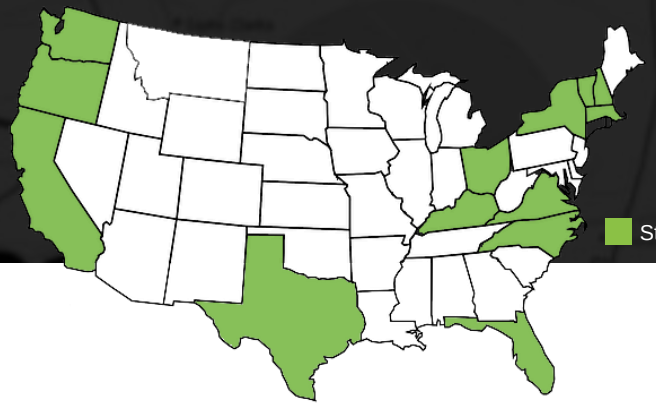
Usgs.gov
FEMA.com
iris.edu
http://www.sms-tsunami-warning.com/

U.S.A.

CURRENT INITIATIVES

Gov. Jerry Brown has signed a 2016-2017 state budget that provides $10 million to help launch a statewide earthquake early-warning system (5mins) called ShakeAlert

5 mins is the closest science and technology have reached to predicting earthquakes.



US is spending $10.5bn* annually on earthquakes

6.1bn $$$$$$$$ building stock losses

3.5bn $$$$$$$$ capital losses

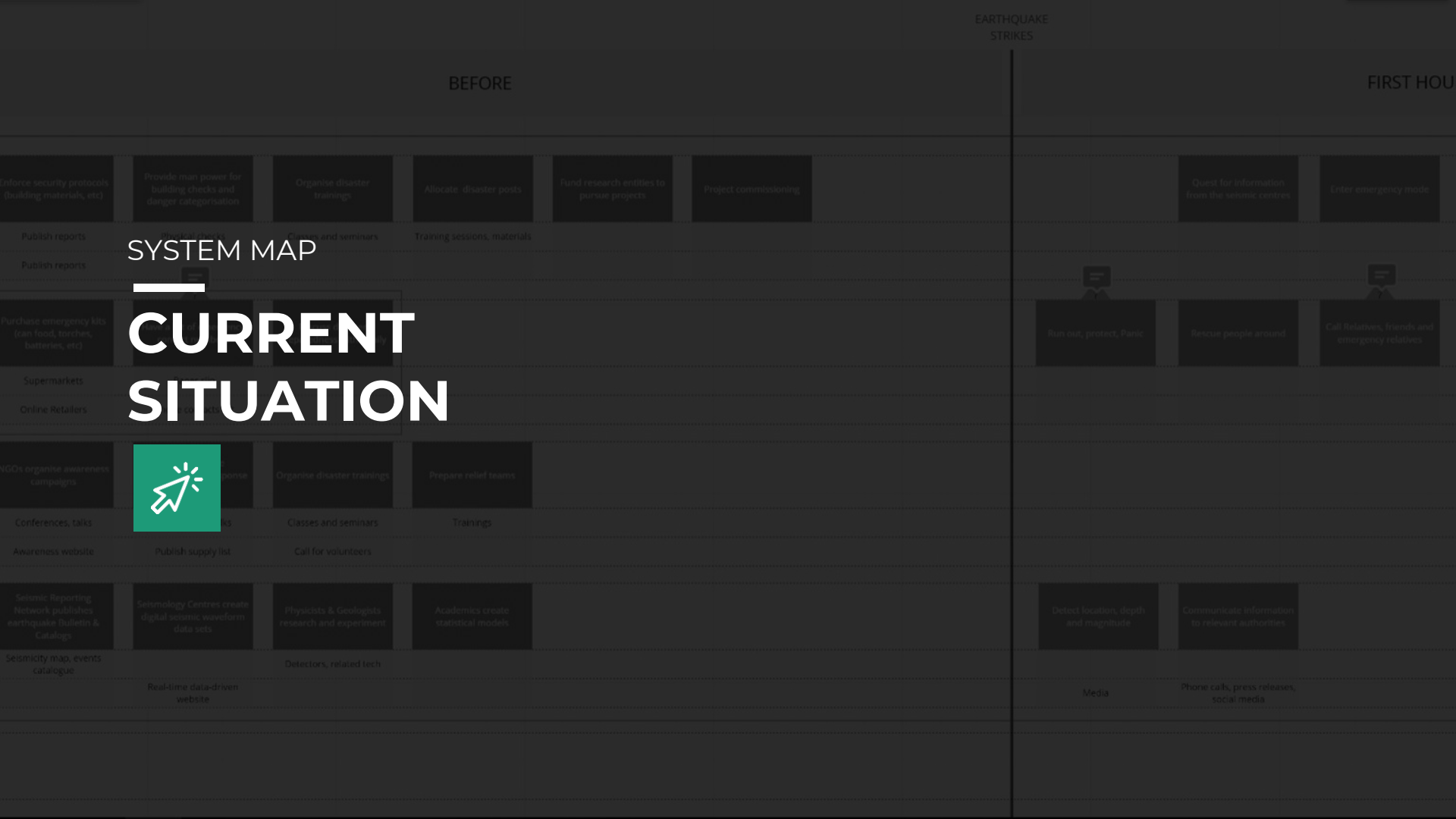
0.9bn $$$$$$$$ income losses

* numbers vary depending on region

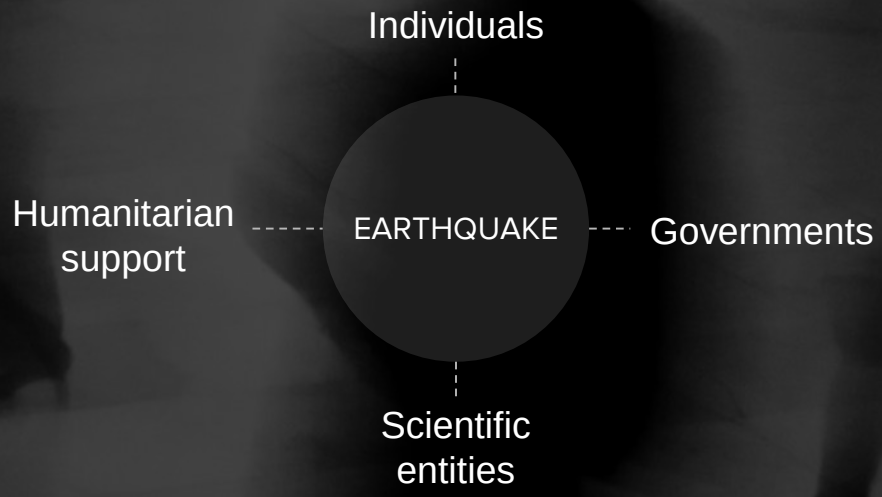
2017, Federal Emergency Management Agency

SYSTEM MAP

CURRENT SITUATION



STAKEHOLDERS



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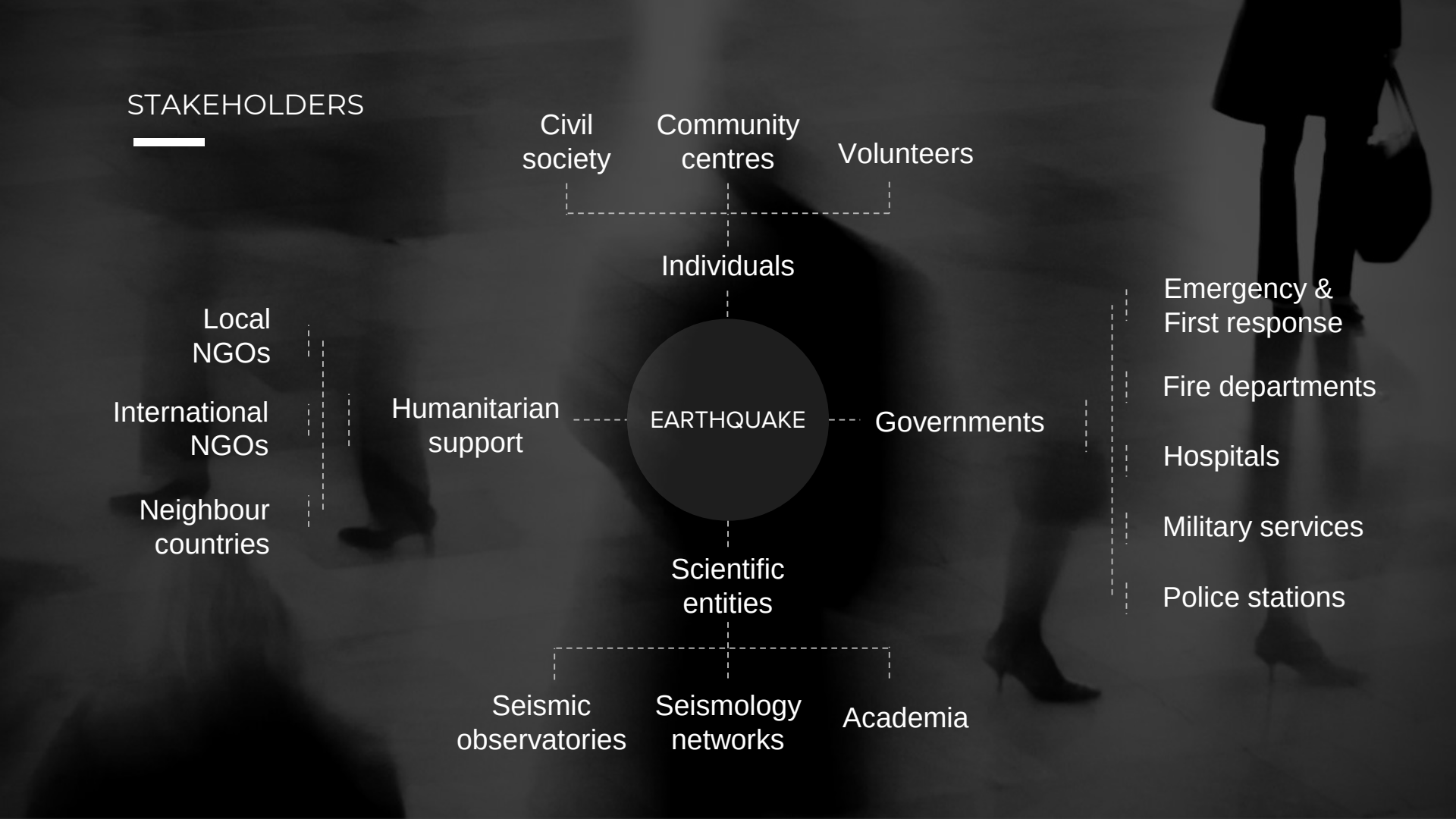
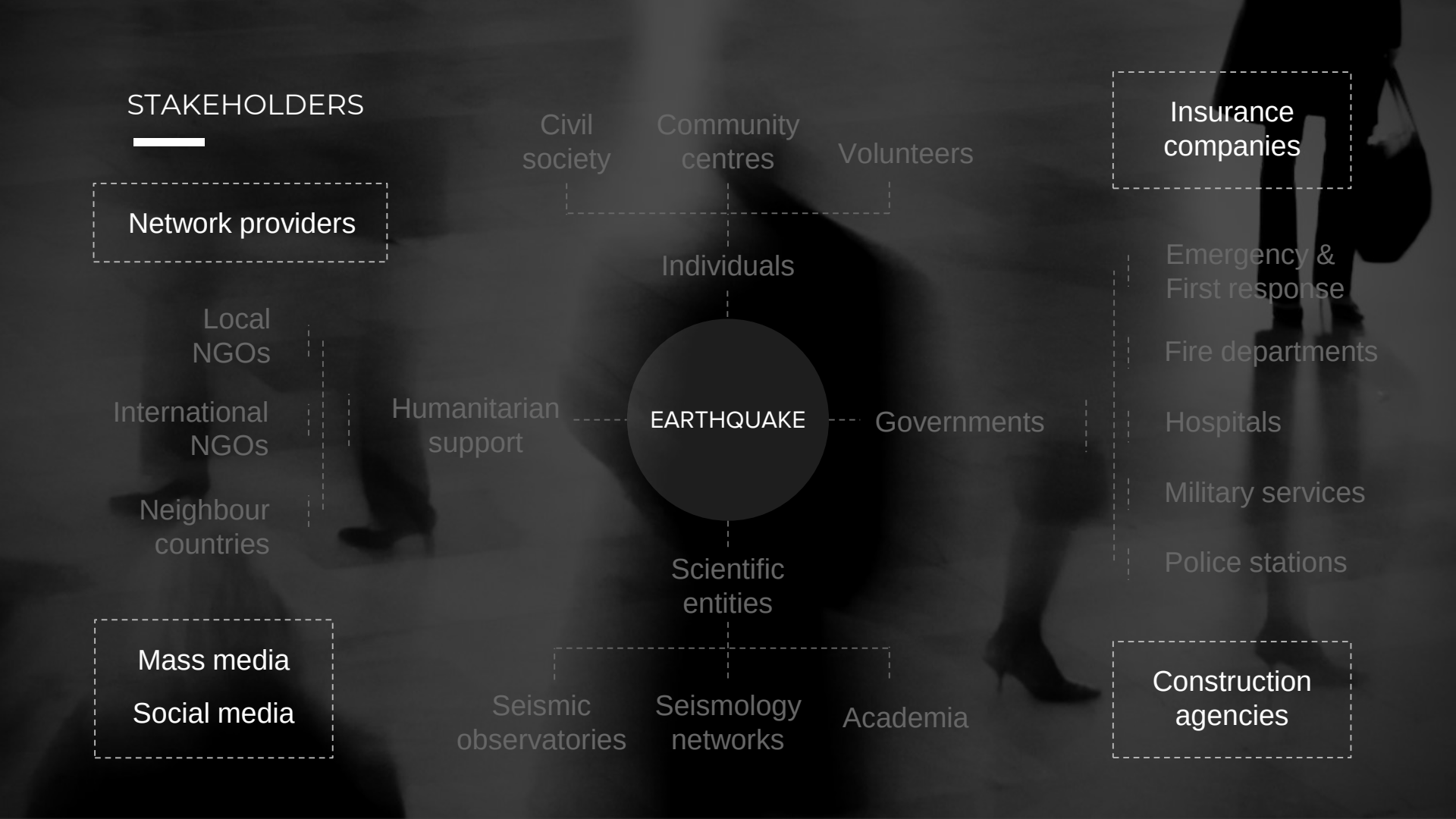
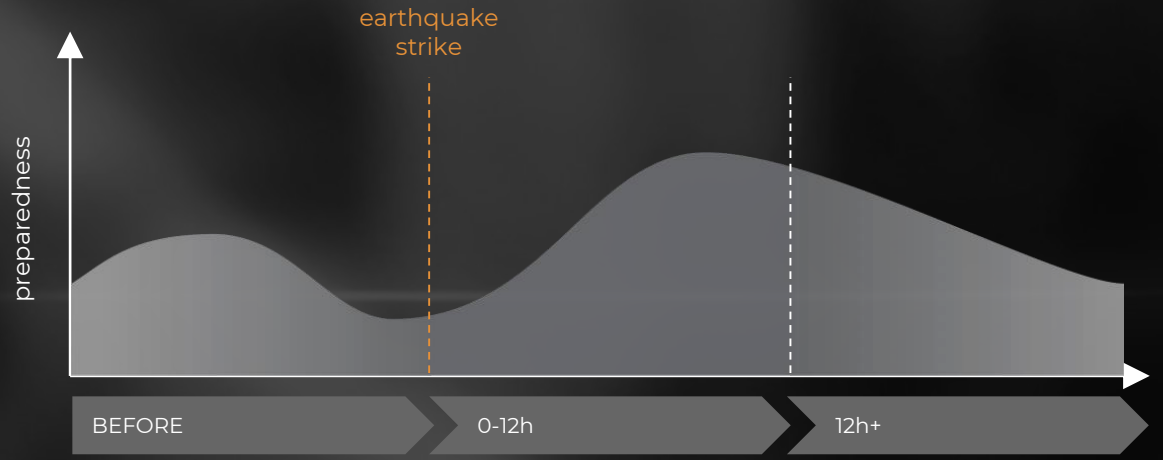



STAKEHOLDERS
Civil society
Community centres
Volunteers
Insurance companies
Network providers
Individuals
Emergency & First response
Local NGOs
Fire departments
International NGOs
Humanitarian support
EARTHQUAKE
Governments
Hospitals
Neighbour countries
Military services
Police stations
Scientific entities
Mass media
Social media
Seismic observatories
Seismology networks
Academia
Construction agencies

IN SYNTHESIS

NOW



SYSTEM ANALYSIS

CHALLENGES

01 LACK OF PREPAREDNESS
fast reaction mechanisms

02 DELAYS
in information and guidance sharing

03 BUREAUCRATIC DELAYS
in planning and sending help

04 ACCESS DIFFICULTIES
12-24h delay for the help to reach affected areas after the strike

SYSTEM ANALYSIS

OPPORTUNITIES

01

IMPROVE PREPAREDNESS
and fast reaction mechanisms

02

ELIMINATE DELAYS
by sharing information and providing guidance on the spot

03

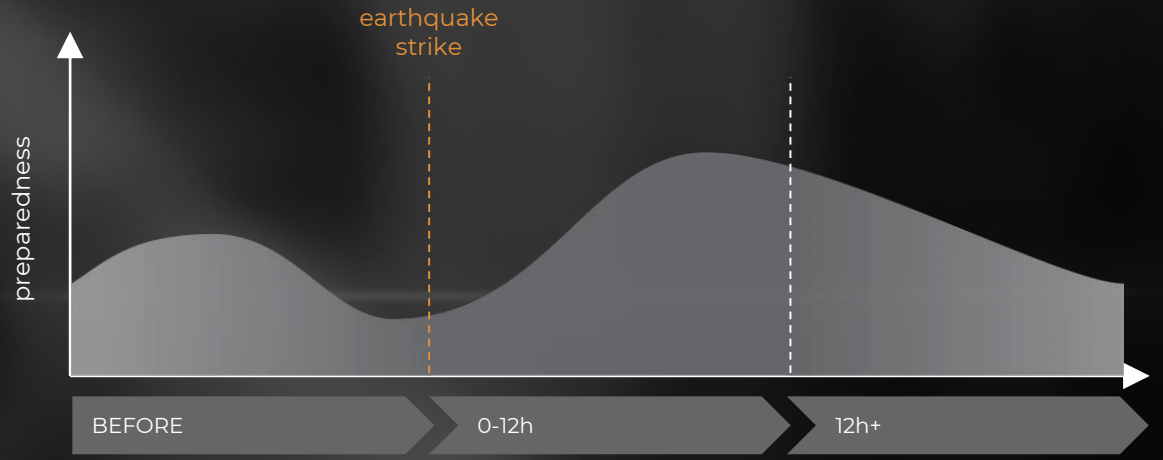
DECREASE DELAYS
calling response units in advance

04

SEND HELP IN ADVANCE
while the infrastructure and transportation systems are not damaged

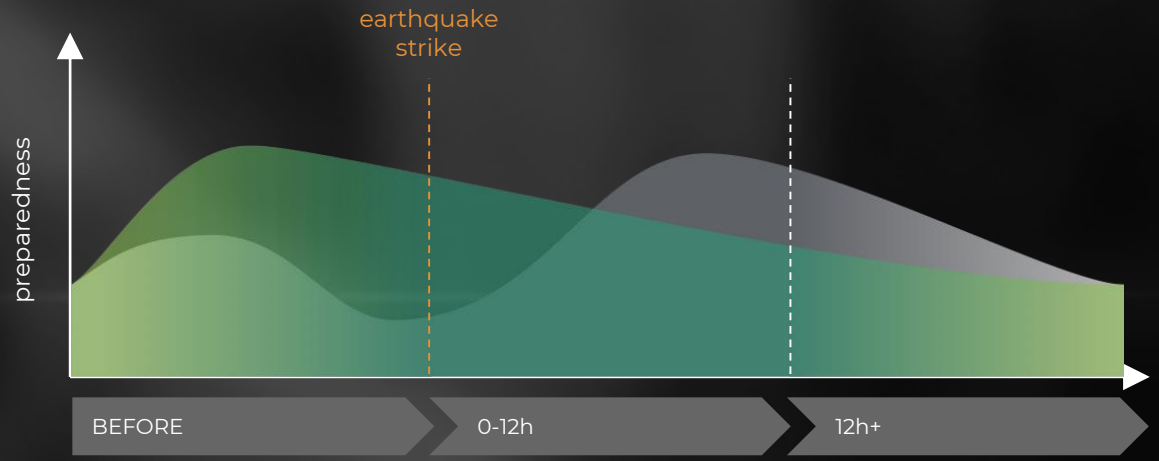
IN SYNTHESIS

NOW



IN SYNTHESIS

FUTURE



WHAT ARE MUONS?

A specific subset of cosmic rays.

Heavy particles, **easily detectable**.
[mass ~207 times bigger than an electron]

MUON DETECTION

THE PROCESS

DECAY

A muon and a neutrino are the result of the decay of either positive or negative pions

MUON DETECTION

THE PROCESS

IONIZATION

Muons interact little with matter - but they interact with magnetic fields, deviating their trajectory

MUON DETECTION

THE PROCESS

DETECTION

The deviated trajectory can be detected, giving information about the material the muon passed through

MUON DETECTION

THE PROCESS

ELABORATION

The data collected is elaborated, highlighting the different levels of stress of the material analysed

MUON DETECTION

WHY

we should be able to predict that an earthquake is going to strike with **6 - 8 hours of advance**.

Gusev, G., Zhukov, V. et al. (2011). Cosmic rays as a new instrument of seismological studies. *Bulletin of the Lebedev Physics Institute*, 38(12), pp.374-379.

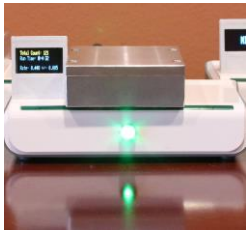
MUON DETECTORS

01

Cosmic Pi - $300

The Cosmic Pi project aims to build the world's largest open source distributed cosmic ray telescope.

02



Cosmic Watch - $100

A detector that sits on a desk and tallies the muons that pass by. The whole system can be built by students.

03

Muon scattering tomography

Scientists use muon tomography in various applications, by differentiating cavities from solid structures.

OPPORTUNITY STATEMENT

HOW MIGHT WE STRENGTHEN EARTHQUAKE EMERGENCY RESILIENCE, BY IMPROVING PREPAREDNESS SYSTEMS?

ORBIS

WHAT WE OFFER

VISION

Our service merges low cost distributed muon flux detectors with a strong network of muon data processing and earthquake support system, for faster reaction rates.

WHAT WE OFFER

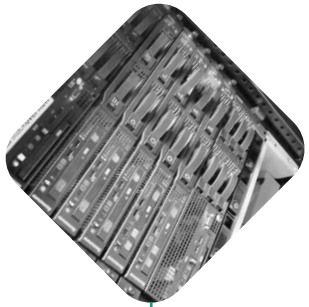
VISION

We aim to shift the earthquake response time before the disaster strikes, by enhancing the detection technologies and capabilities according to each country’s needs.

WHAT WE OFFER

HOW

HARDWARE
Affordable server rack based solution

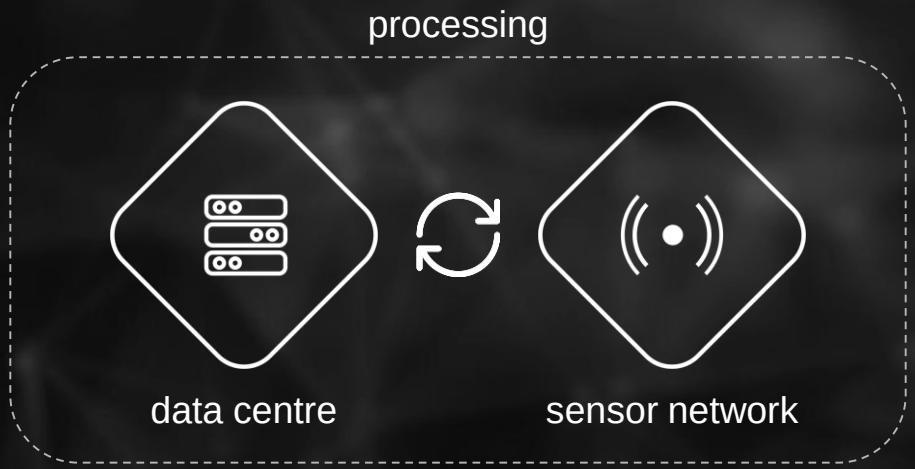


NETWORK
Data collection network

SUPPORT
Information and humanitarian

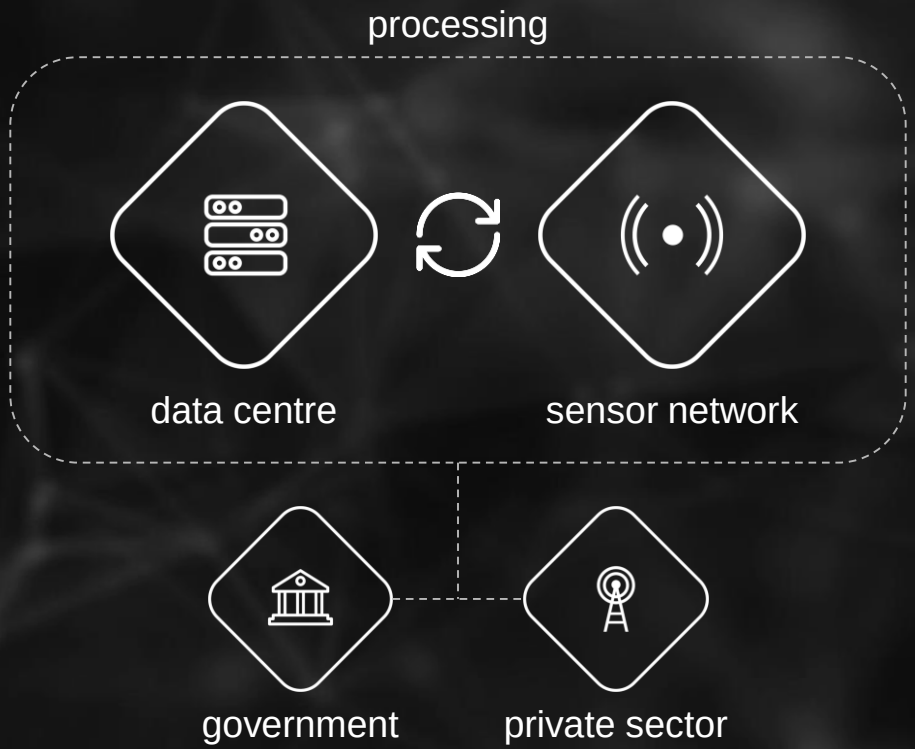
SERVICE PROPOSITION

HOW



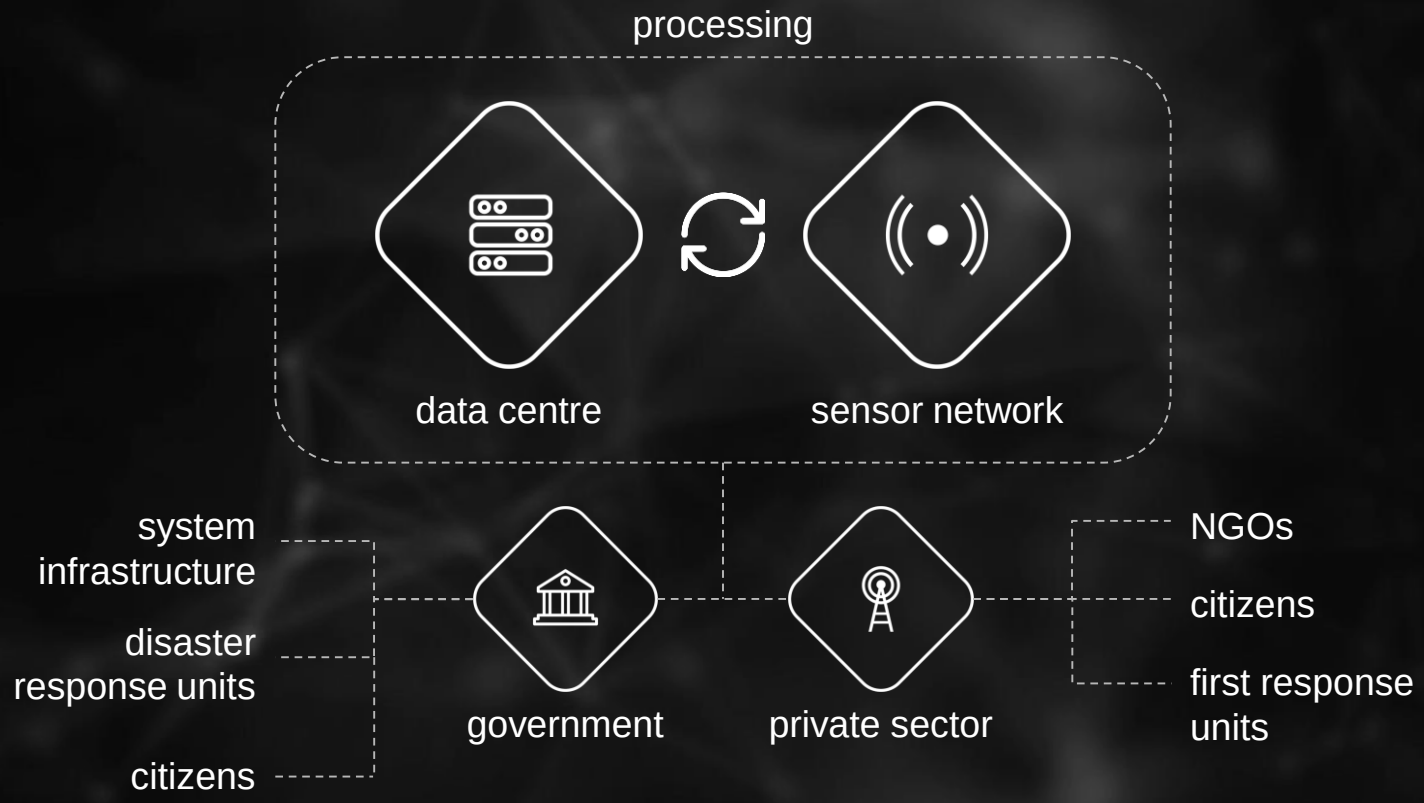
SERVICE PROPOSITION

HOW



SERVICE PROPOSITION

HOW



THE SERVICE

OUR GOALS

01 **Enhance** the implementation capacity

02 **Increase** emergency preparedness

03 **Build** disaster resilience

JOURNEY

STORYBOARD

01
Constantly collecting muon activity data
using our server rack sensors

02

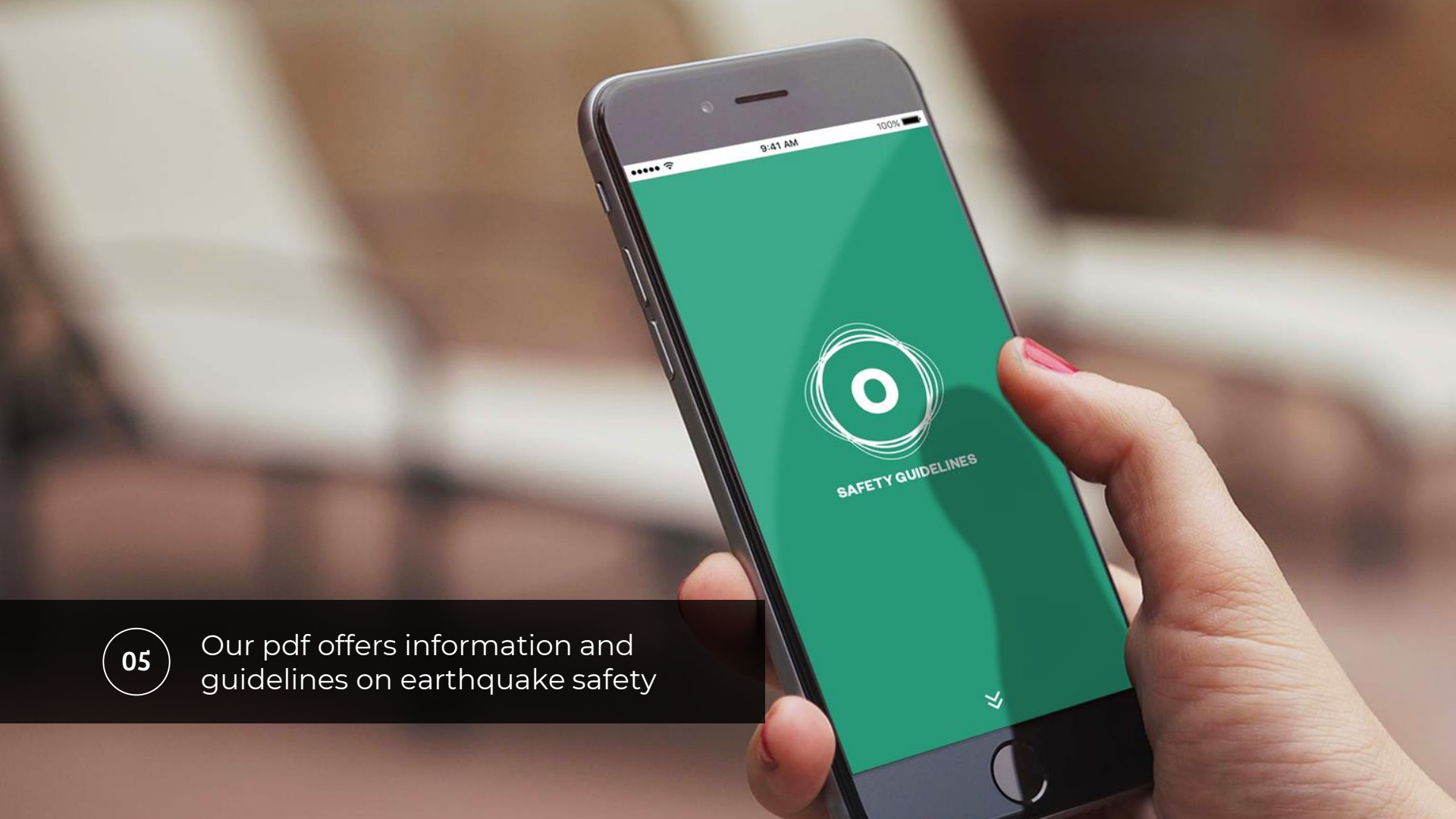
Analysing the data. Muon irregular activity is detected and region affected is pinpointed

03

Government is alerted to prepare for emergency response for the specific region

04

Government is informing the citizens about the upcoming earthquake



05

Our pdf offers information and guidelines on earthquake safety

06

Government is informing the citizens about the upcoming earthquake

07

Aid NGOs are informed and deployed before the earthquake strikes

08 People are safe during the earthquake

09

External help and funding arrives knowing the amount of people that would be affected

IMPACT

LIVES SAVED

People are already safe in shelters during the strike

MONEY SAVED

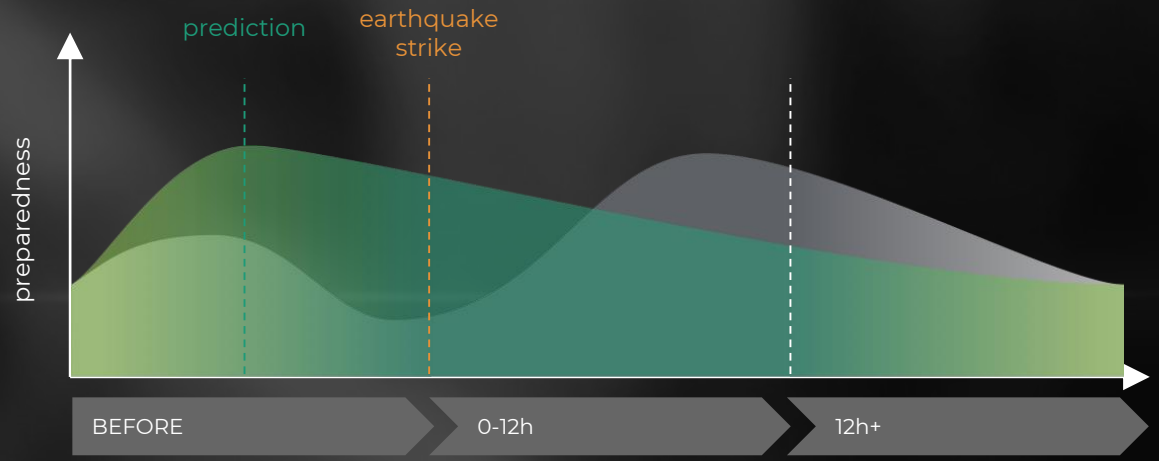
Less expenses for patient care, heavy injured assistance, public worker insurance and disease outbreaks

REACTION TIME REDUCED

Processes already mobilised before the strike

IN SYNTHESIS

FUTURE



MILESTONES

PHASE 1

Build Startup and collaboration with Universities

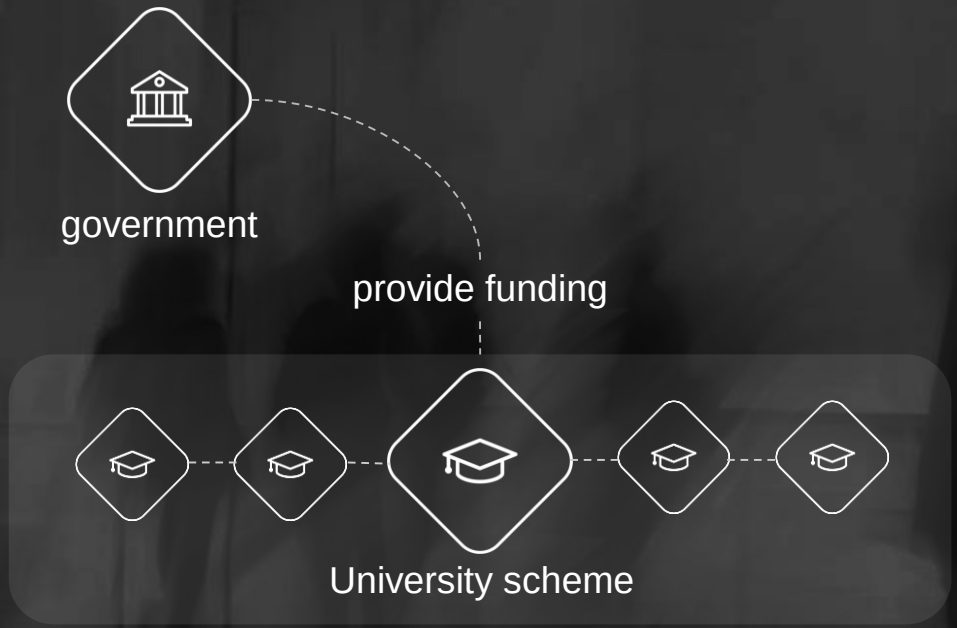
Validate the connection between muon flux and earthquake prediction

PHASE 2

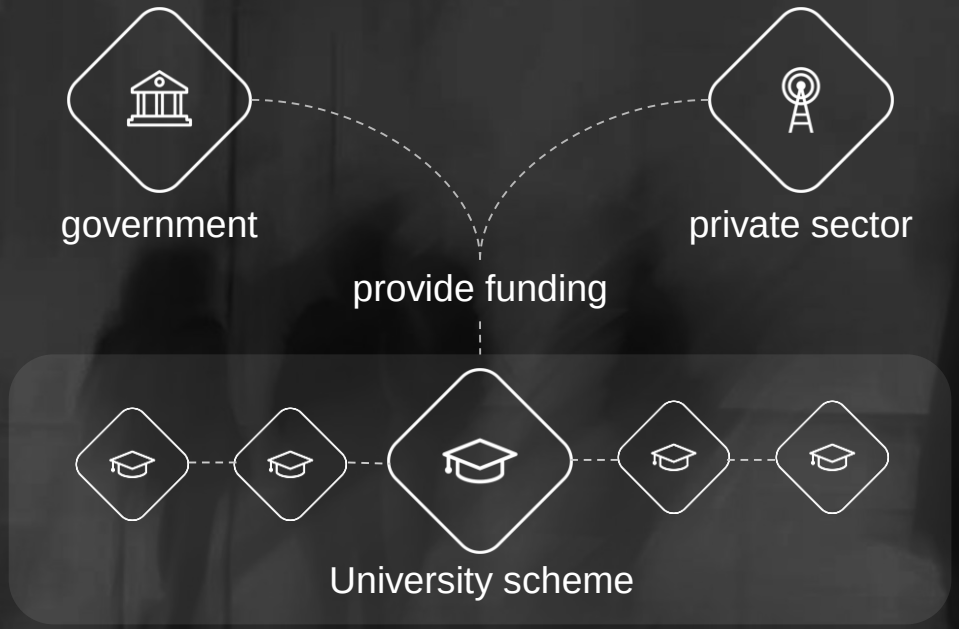
Scale up the Startup and apply in different regions

Establish the emergency resilience system and scale its implementation

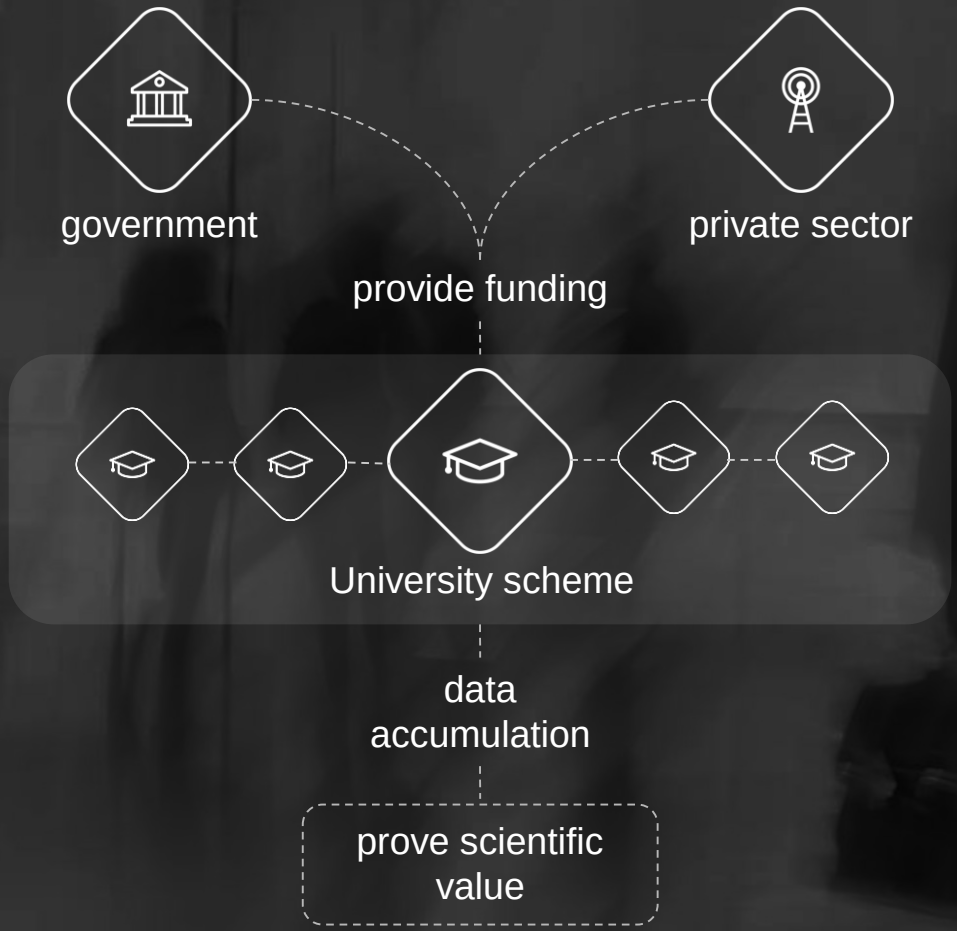
PHASE 1



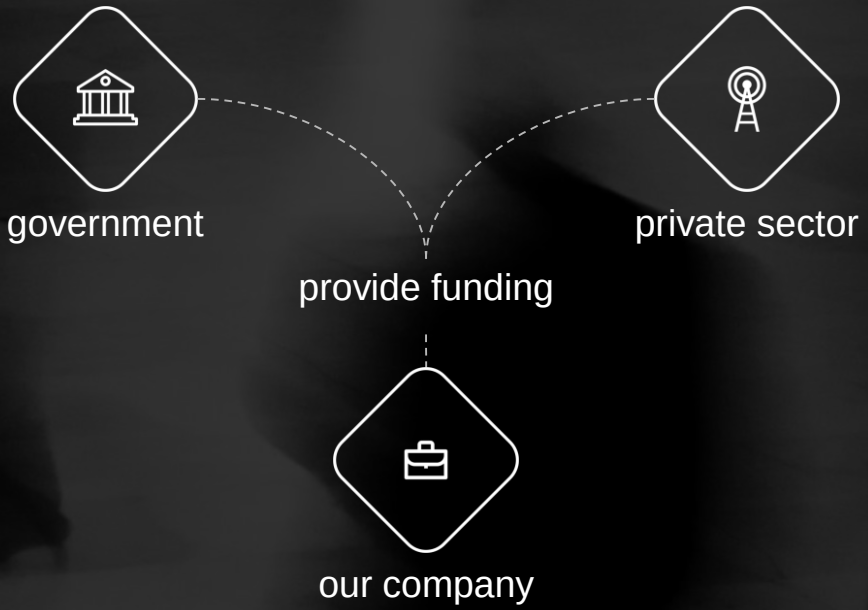
PHASE 1


government
private sector
provide funding
University scheme

PHASE 1


government
private sector
provide funding
University scheme
data
accumulation
prove scientific
value

PHASE 2

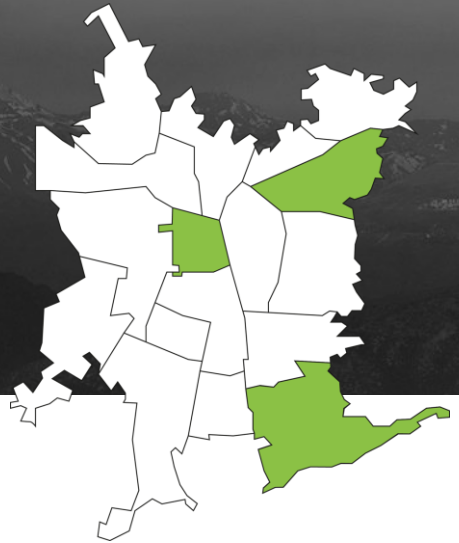


PHASE 2

government
private sector
provide funding
our company
free data
citizens

FOCUS AREA

SANTIAGO DE CHILE



641 km²

Largest city and capital Of Chile

7,314,176

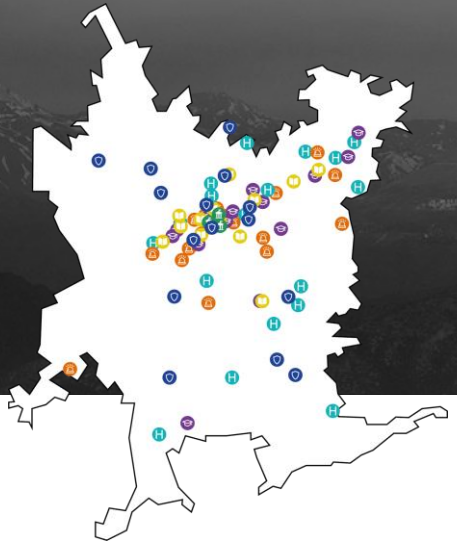
Most densely populated conurbation

Ring of Fire

Nazca & South American tectonic plates

AREAS OF DISTRIBUTION

SANTIAGO DE CHILE



15 universities

13 libraries

6 ministries

18 hospitals

15 police stations

17 fire stations

PROGRESS

NEXT STEPS

01 **Business Report** &
Revenue stream

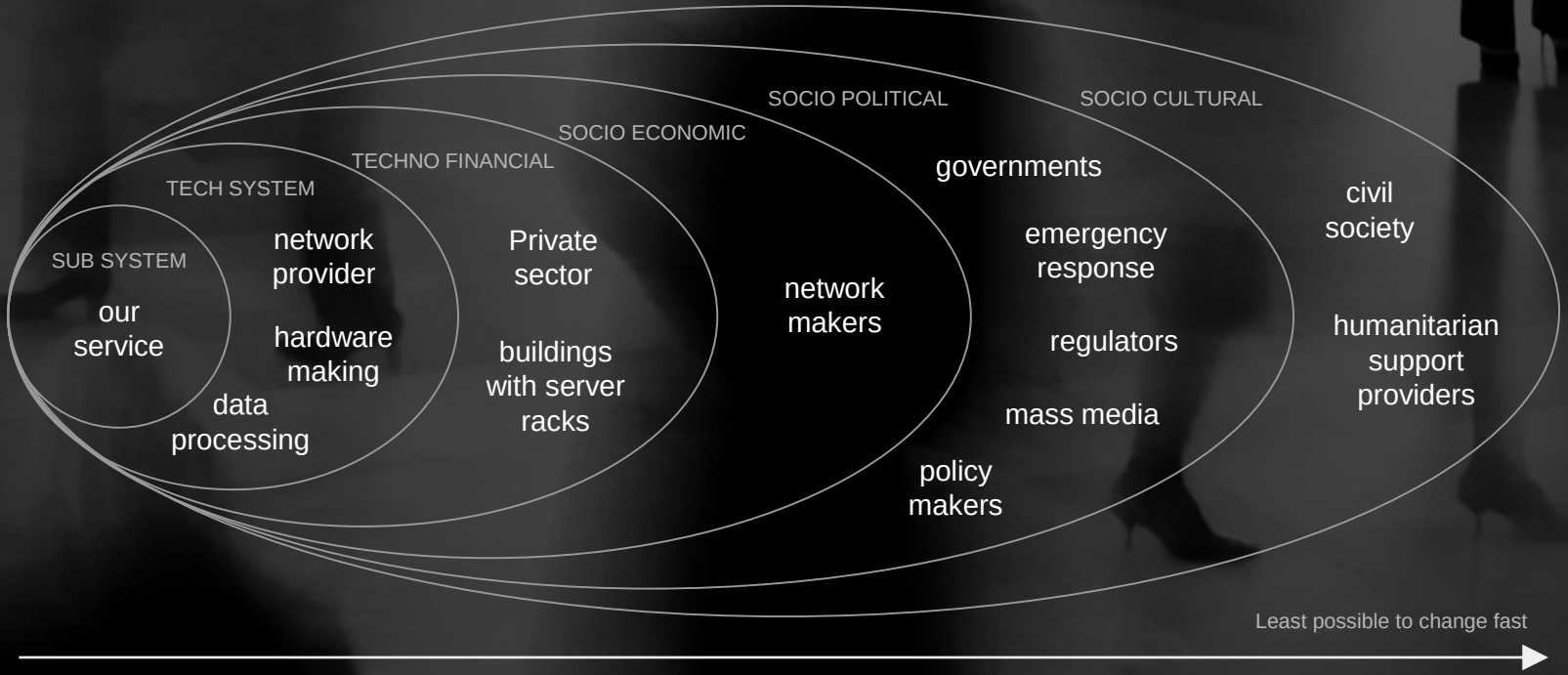
02 **Prototype:** test
Hardware components

03 **Prototype:** data
Network interfaces

Q&A

STAKEHOLDERS

WHO IS INVOLVED



THE 4 PHASES

EMERGENCY MANAGEMENT

Risk management