



A FRAMEWORK

Out of Many, One

Public Health Systems Solution
To Provide for the Common Defense
Of the United States of America

Charity Dean MD, MPH&TM
PCAST Inaugural Session
September 29, 2021

AGENDA

Out of Many, One

- Introduction
- Current State: Why the U.S. Public Health System Failed at Containment
- Desired Future State
 - Data, Intelligence, Decisions, Actions, Outcomes
- How We Get There: A Systems Solution to Provide for the Common Defense
 - Intelligence Infrastructure
 - Decision & Authority Infrastructure
 - Operational Infrastructure
 - Trust of the American People



THE IMPORTANCE OF CONTAINMENT

The U.S. must establish **containment** as an option when a fast-moving novel pathogen emerges

Situation

- The risk of global spread of novel pathogens has increased exponentially. This will happen again. The pathogen could be (much, much) worse
- The U.S. did not even try to contain COVID-19

Problem

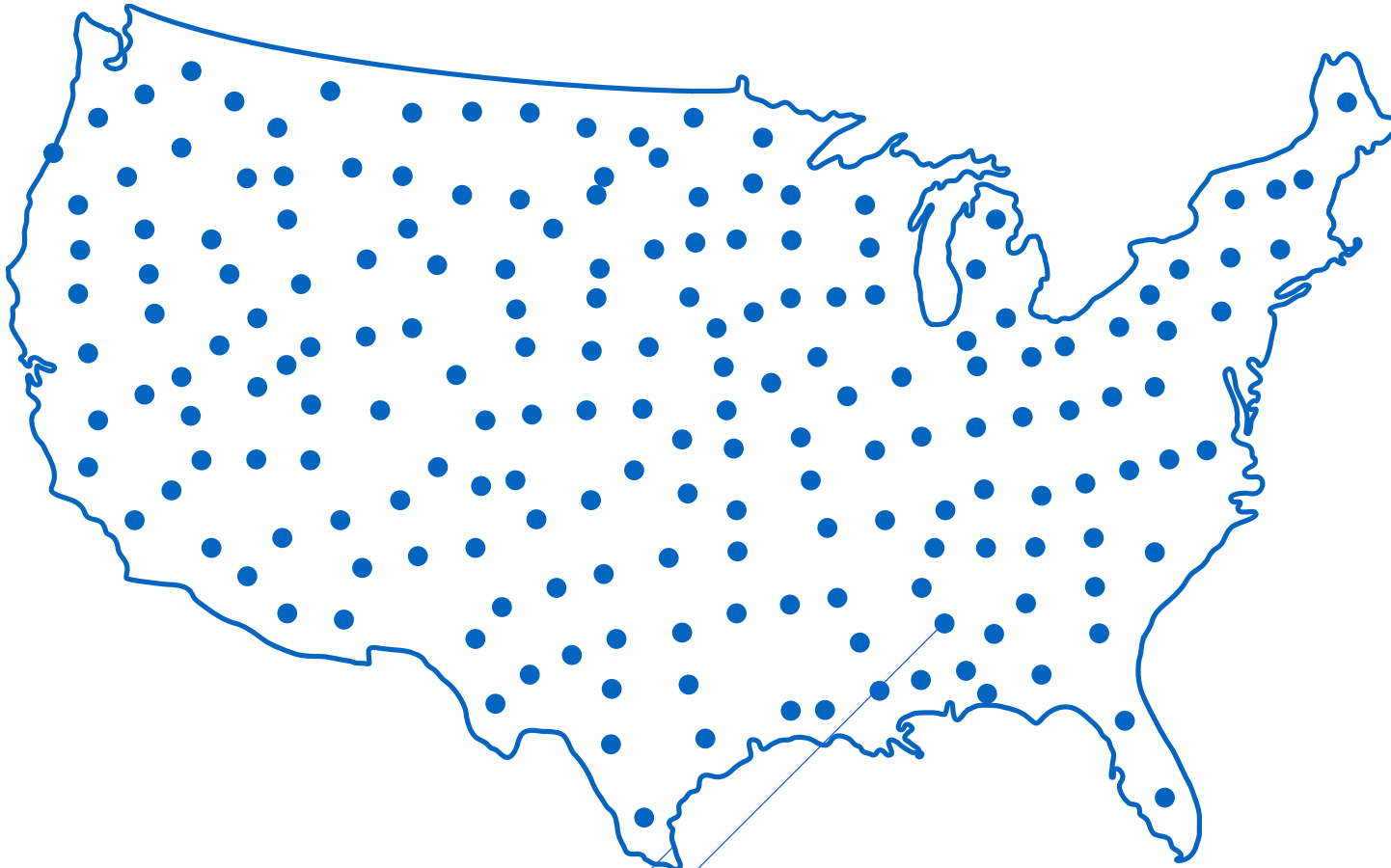
- Detection and containment of a fast-moving novel pathogen is not possible under the current U.S. public health and health care systems
- As demonstrated by COVID-19, lack of containment is a threat to national security, economic security, and health security
- All containment is local; it happens on the front-lines

Objective

- Leverage technology & science to design a system capable of detecting and containing a fast-moving novel pathogen that appears simultaneously across the U.S.

CURRENT STATE: WHAT IS THE US PUBLIC HEALTH SYSTEM?

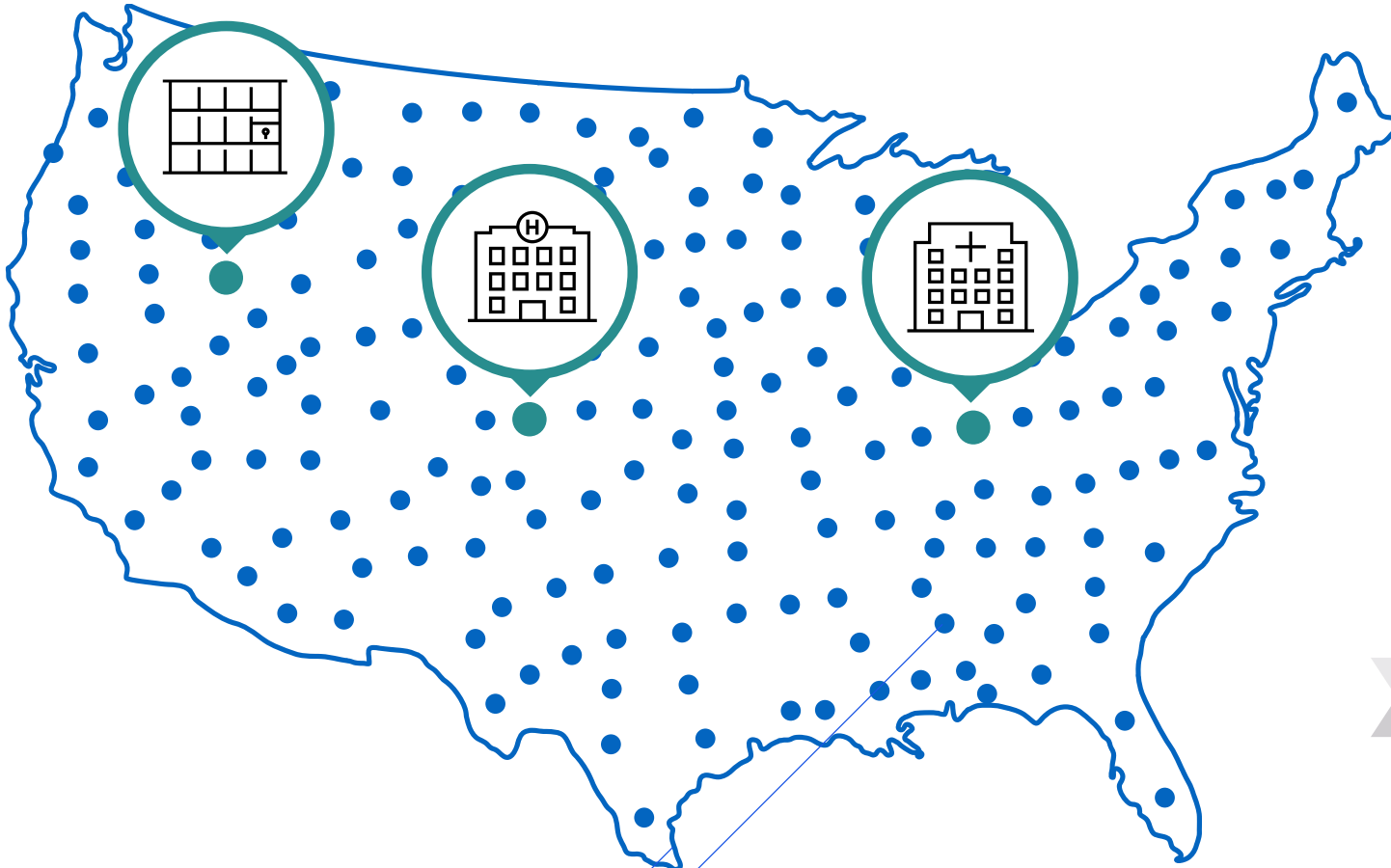
Disconnected and Unidirectional



- ~3,200 local public health departments (LHDs)
- Front-lines disease control & prevention
- Slow, cumbersome, antiquated technology: paper files, fax machines, email, spreadsheets, phone calls, snail mail
- Every LHD is subject to a political hierarchy; every local & state Health Officer a political appointee

CURRENT STATE: WHAT IS THE US PUBLIC HEALTH SYSTEM?

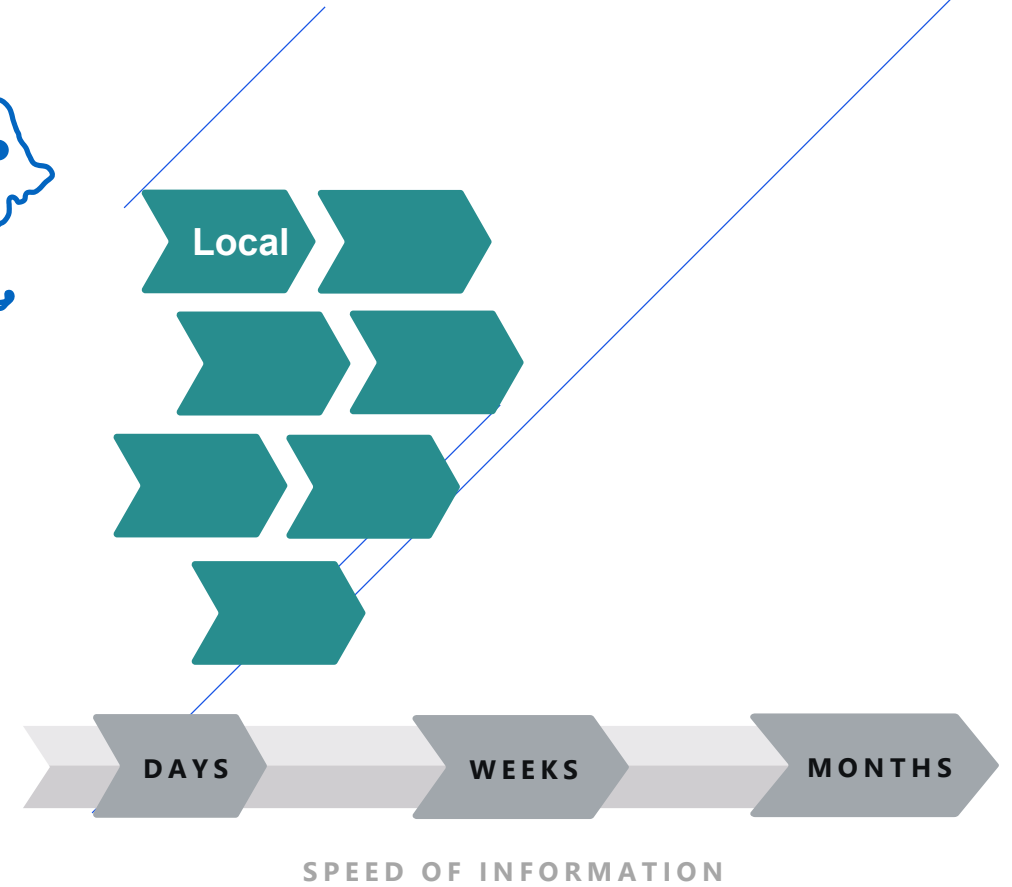
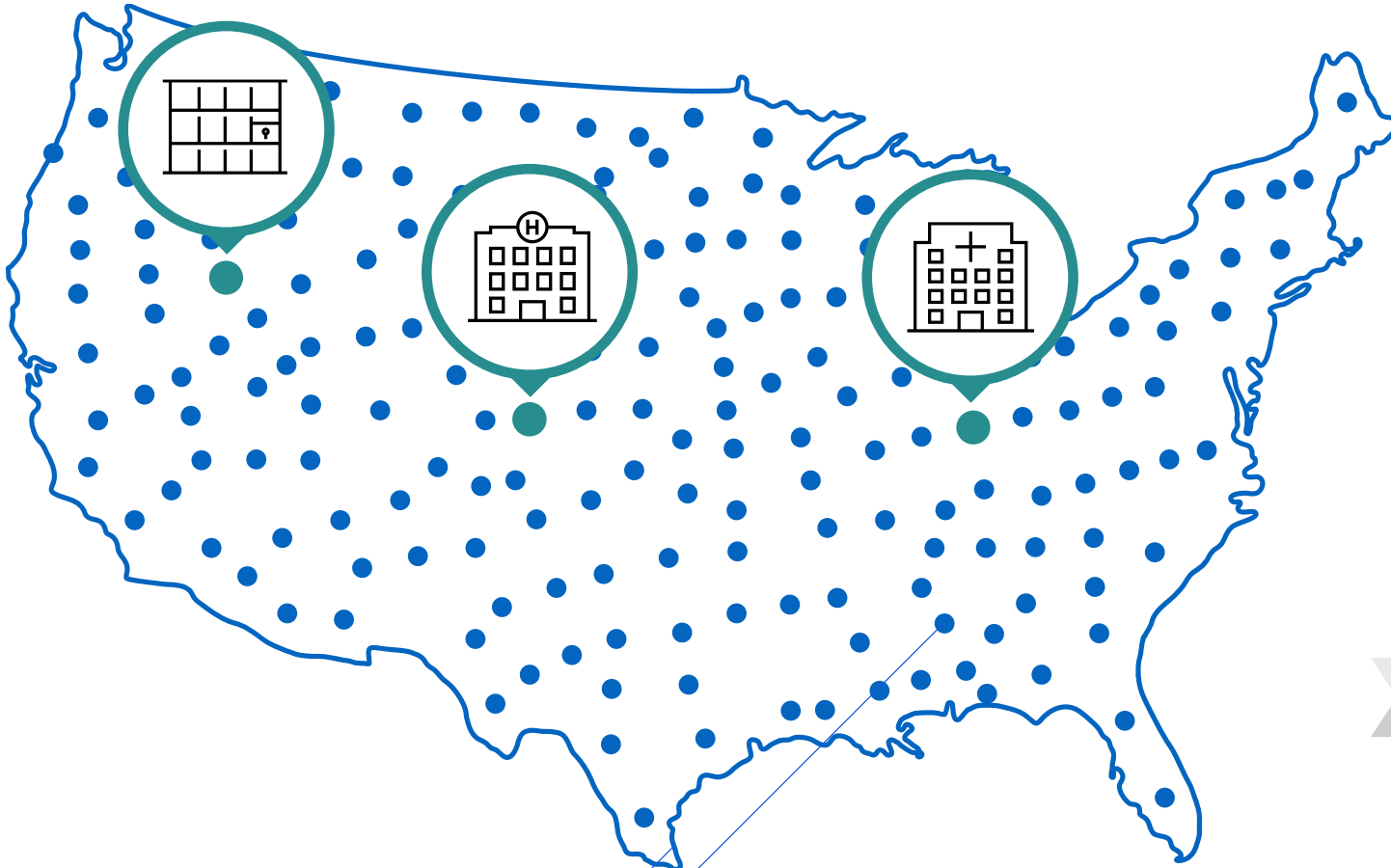
Disconnected and Unidirectional



SPEED OF INFORMATION

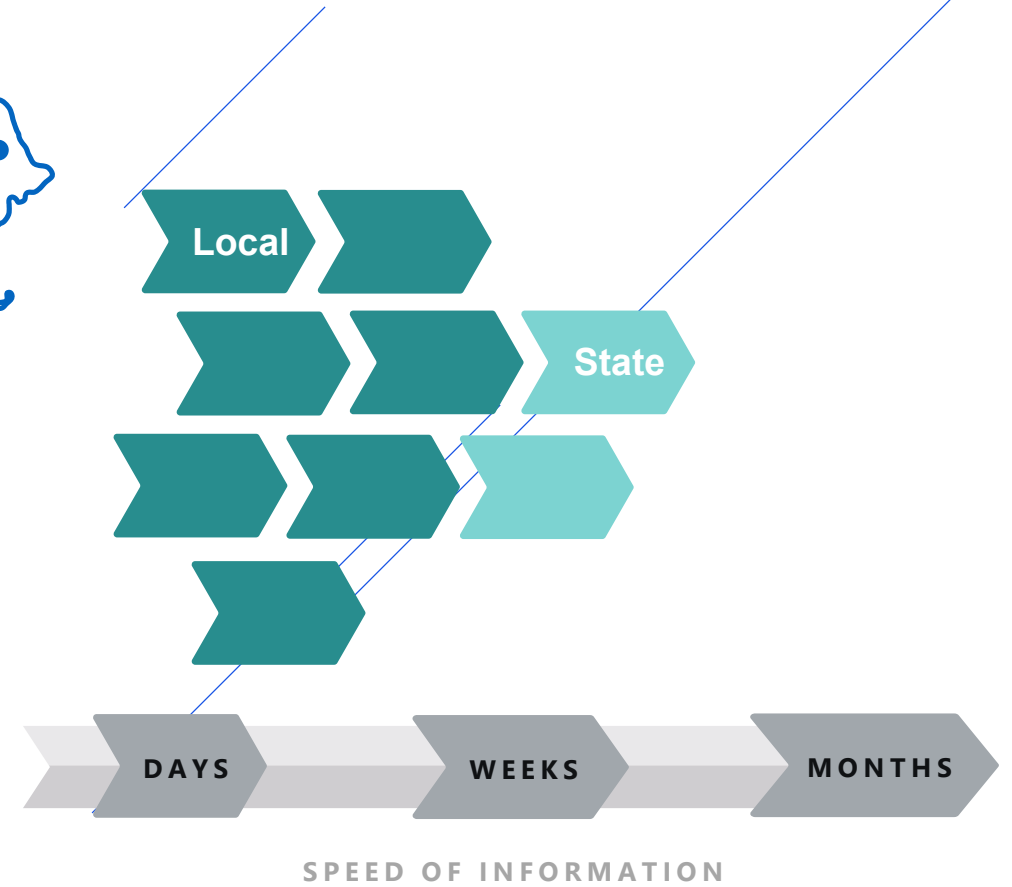
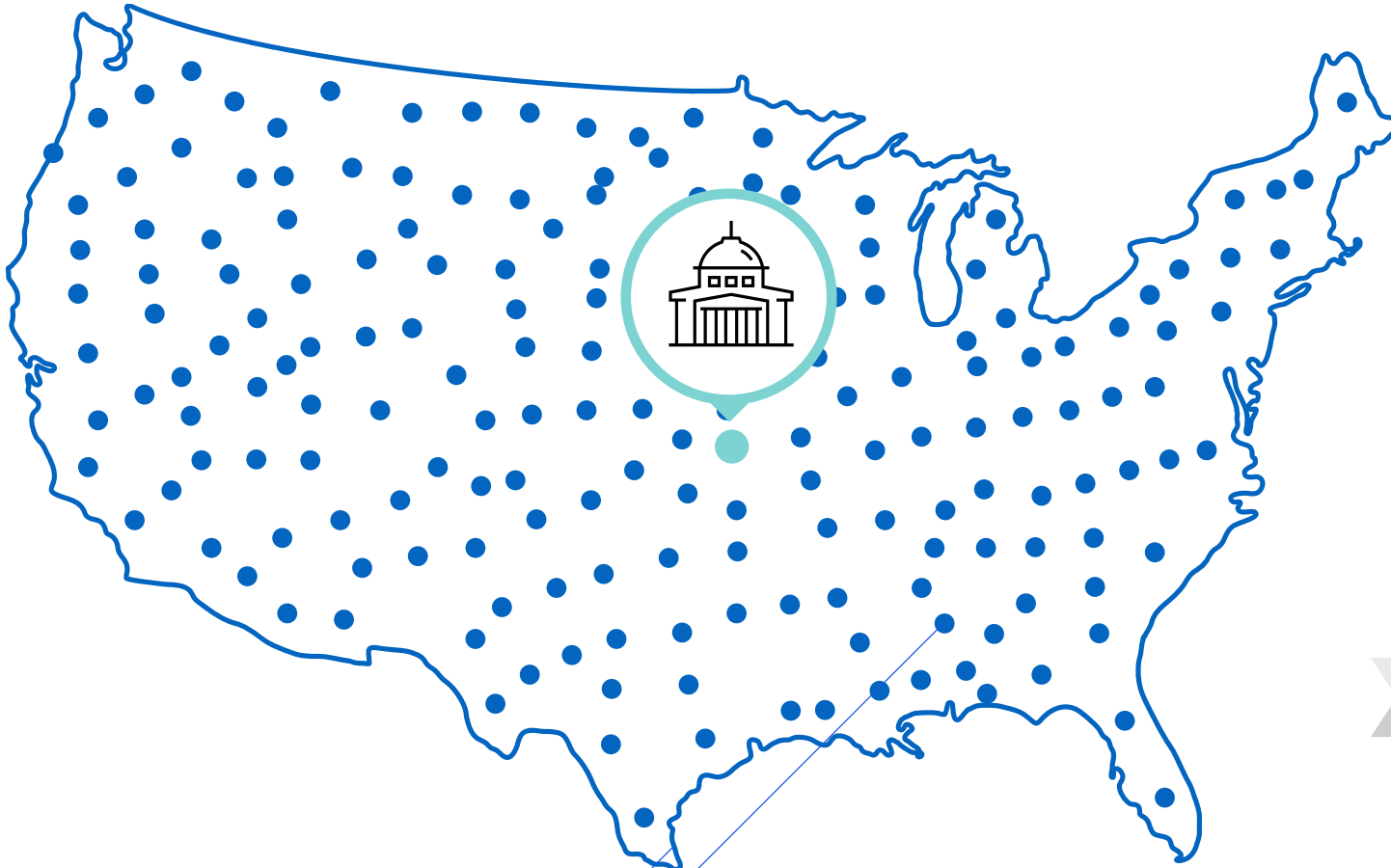
CURRENT STATE: WHAT IS THE US PUBLIC HEALTH SYSTEM?

Disconnected and Unidirectional



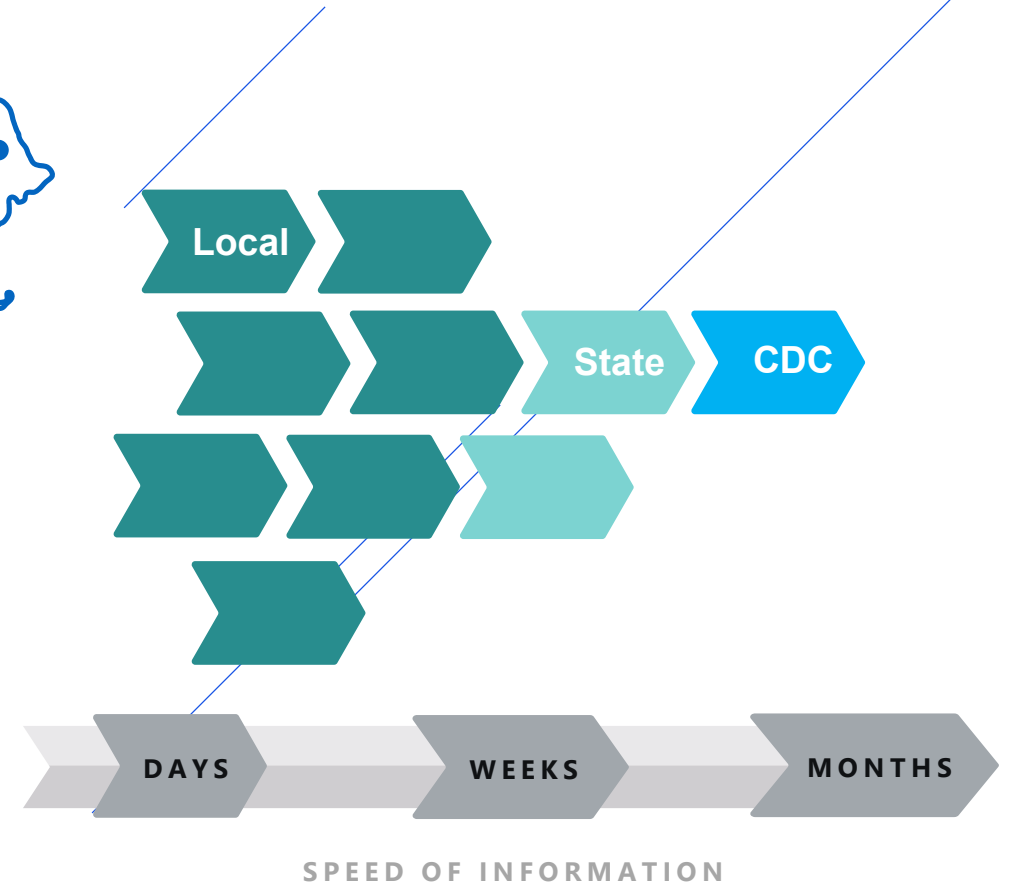
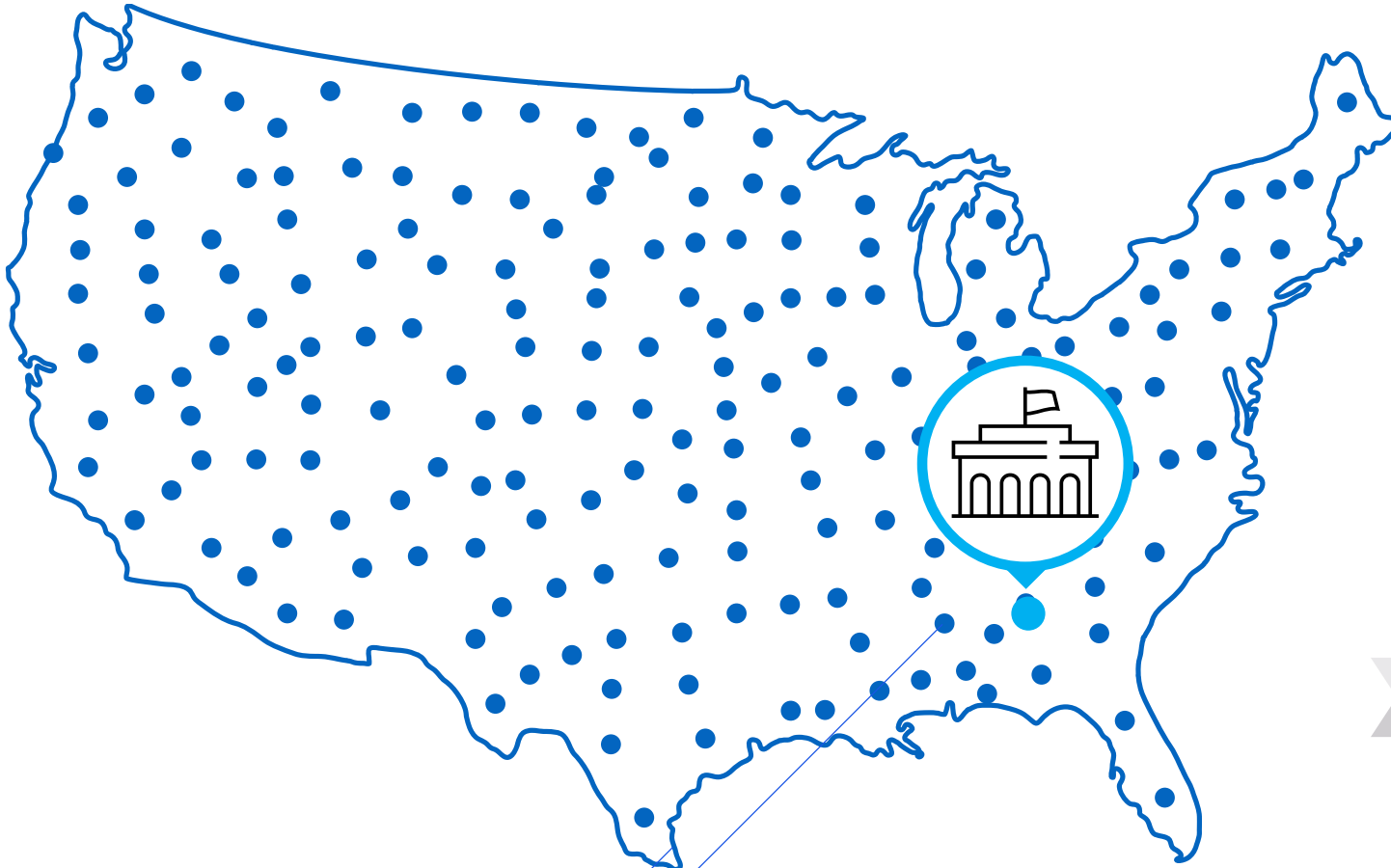
CURRENT STATE: WHAT IS THE US PUBLIC HEALTH SYSTEM?

Disconnected and Unidirectional



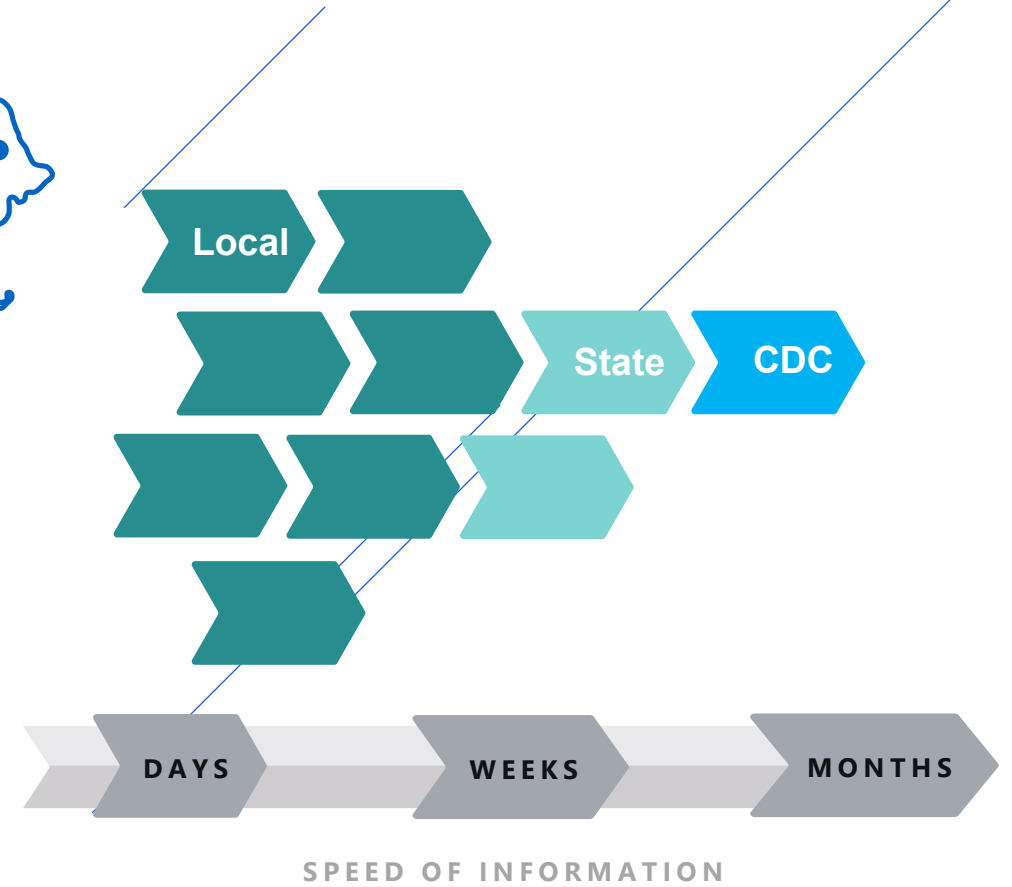
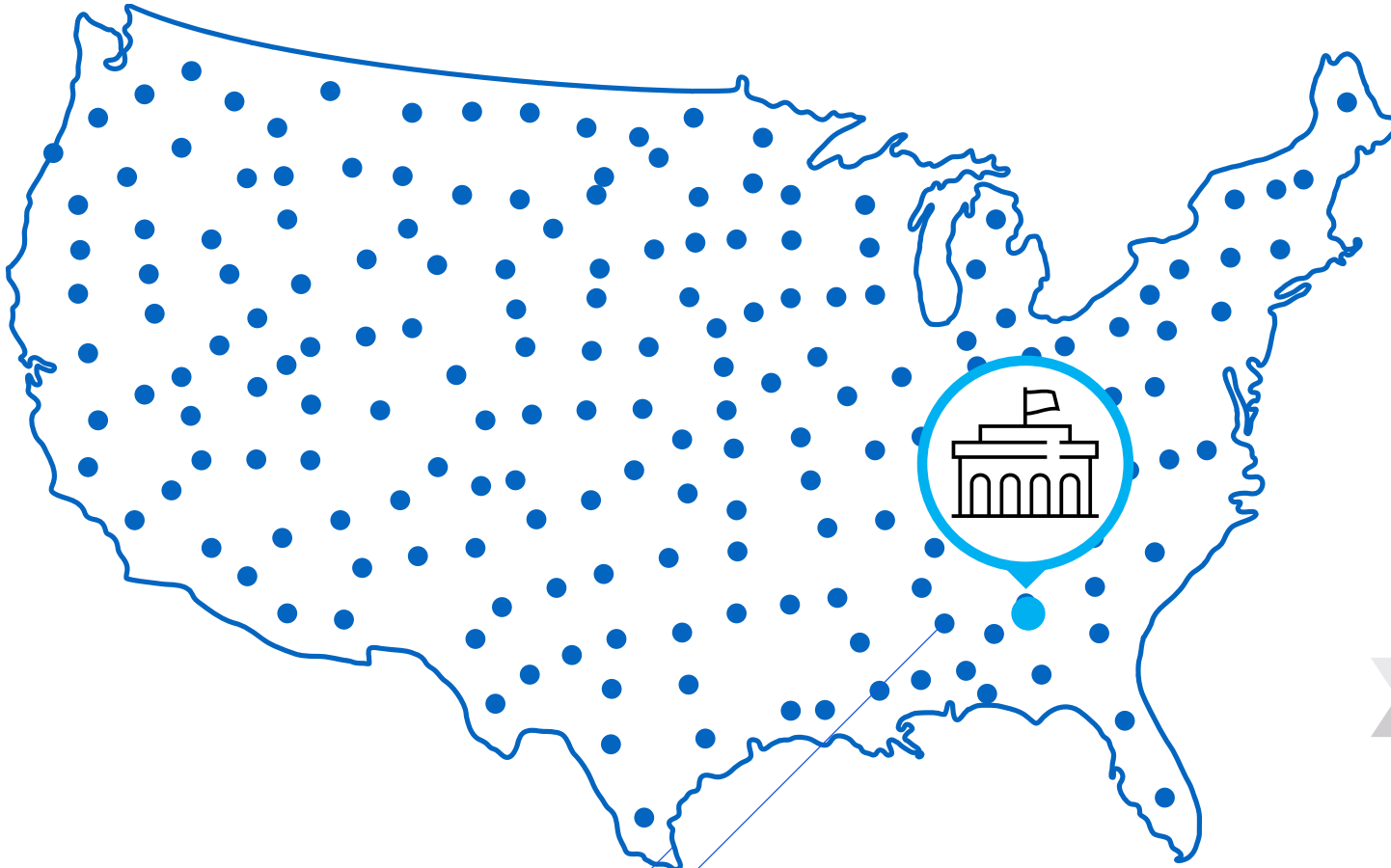
CURRENT STATE: WHAT IS THE US PUBLIC HEALTH SYSTEM?

Disconnected and Unidirectional



CURRENT STATE: WHAT IS THE US PUBLIC HEALTH SYSTEM?

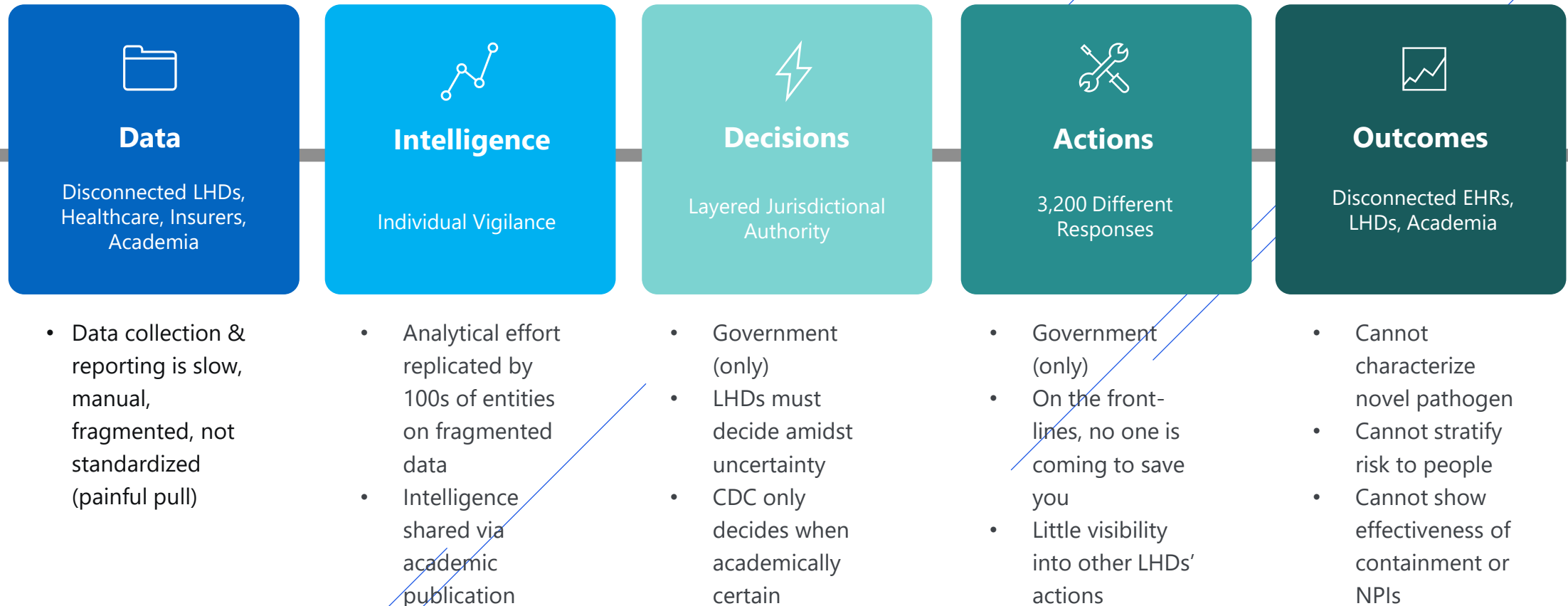
Disconnected and Unidirectional



Siloed, Fragmented, Slow, Disconnected

“A bad system will beat a good person every time”

Edwards Deming, 1993



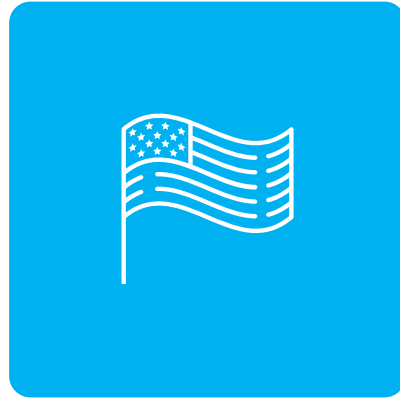
DESIRED FUTURE STATE

Guiding Principles



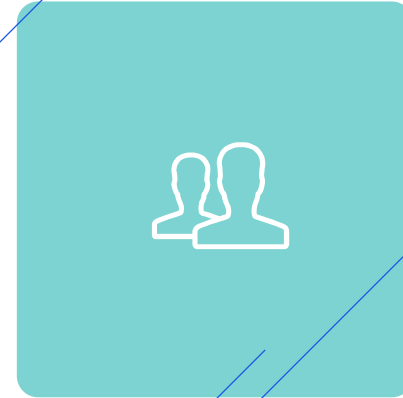
Speed

- The system must move faster than the pathogen.
- The technology exists.



Resilience

- Cannot be hijacked by political interests at any level (local/ state/ federal)



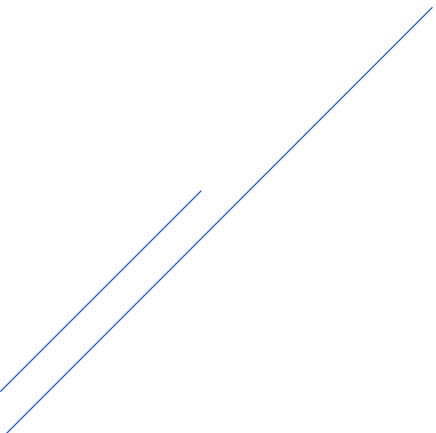

Whole-of-Society Response

- Private Sector / Businesses
- Government
- Community Based Orgs
- Schools
- Healthcare
- Leverages the American public



HOW WE GET THERE

4 Pillars

- 1 Intelligence Infrastructure
 - 2 Authority Infrastructure
 - 3 Operational Infrastructure
 - 4 Trust of the American People
- 
- 

1 Intelligence Infrastructure

Goal

- Unified intelligence platform that predicts and detects localized disease threats in real-time, alerts appropriate nodes of risk-level to inform decisions and actions, and captures outcomes of individuals and populations ***as they are happening***

This enables

- Characterization of the pathogen in real-time (R_0 , CFR, virulence, genomic attributes, incubation period, infectious period, mode of spread, disproportionately impacted cohorts, etc.)
- One unified containment effort by all the network nodes across space and time



1 Intelligence Infrastructure

Technology Platform Capabilities

- Uniform, real-time data ingestion for clinical, epidemiological, population, and genomic data
- Detects disease threats; early characterization
- Forecasts trends and risk-levels
- Alerts nodes of risk level and potential courses of action
- Captures outcomes of interventions, closing the feedback loop

Users

- All actors (government, healthcare, private, individuals) interact with the same system, depositing data and gaining situational awareness
- Robust privacy + security architecture

CURRENT STATE: PUBLIC HEALTH + HEALTHCARE



DESIRED FUTURE STATE

Real-time, networked intelligence by design

Data

Privacy-preserving data integration across sectors, jurisdictions, governments; electronic data exchange for reportable diseases & clinical symptoms/ outcomes (push)

Outcomes

Platform ingests timely, accurate, integrated EHR outcomes data from all EHRs; captures public health outcomes data from decisions/actions; characterization of novel pathogen happens in near real-time; risk stratification of people groups happens in near real-time; effectiveness of containment and NPIs determined in near real-time enabling fast strategy pivots as pathogen is characterized and/ or mutates (e.g., airborne vs. fomite spread); US provides insights to rest of the world

Actions

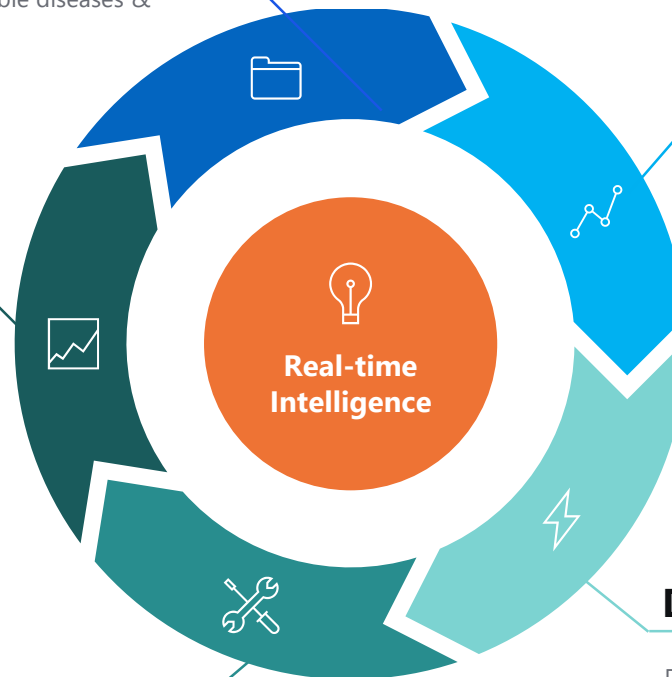
One unified containment response by all nodes in the network; mutual aid and resources flow to front-lines automatically and correlated with pre-determined threat levels; captures local actions in real-time for the benefit of the network

Intelligence

AI/ML pattern detection provides early warning; models fit in real-time at local/state/national scales; converts scattered/ unreliable data into pattern recognition; intelligence shared via software; reality between people, private sector, all governments

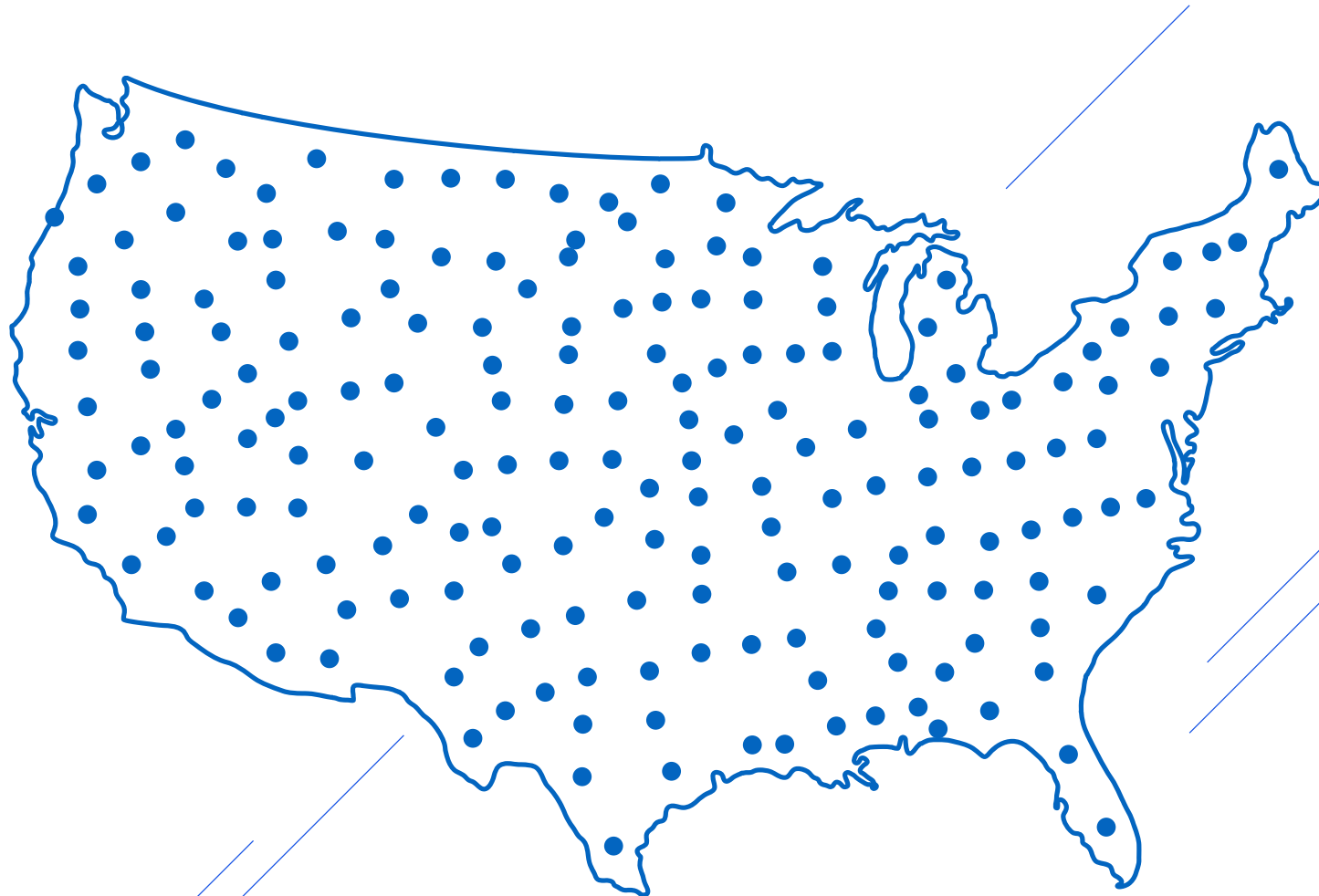
Decisions

Designed to support decision-making amidst uncertainty; empowers decision-makers to moves at the speed of technology; captures local decisions in real-time for the benefit of the network



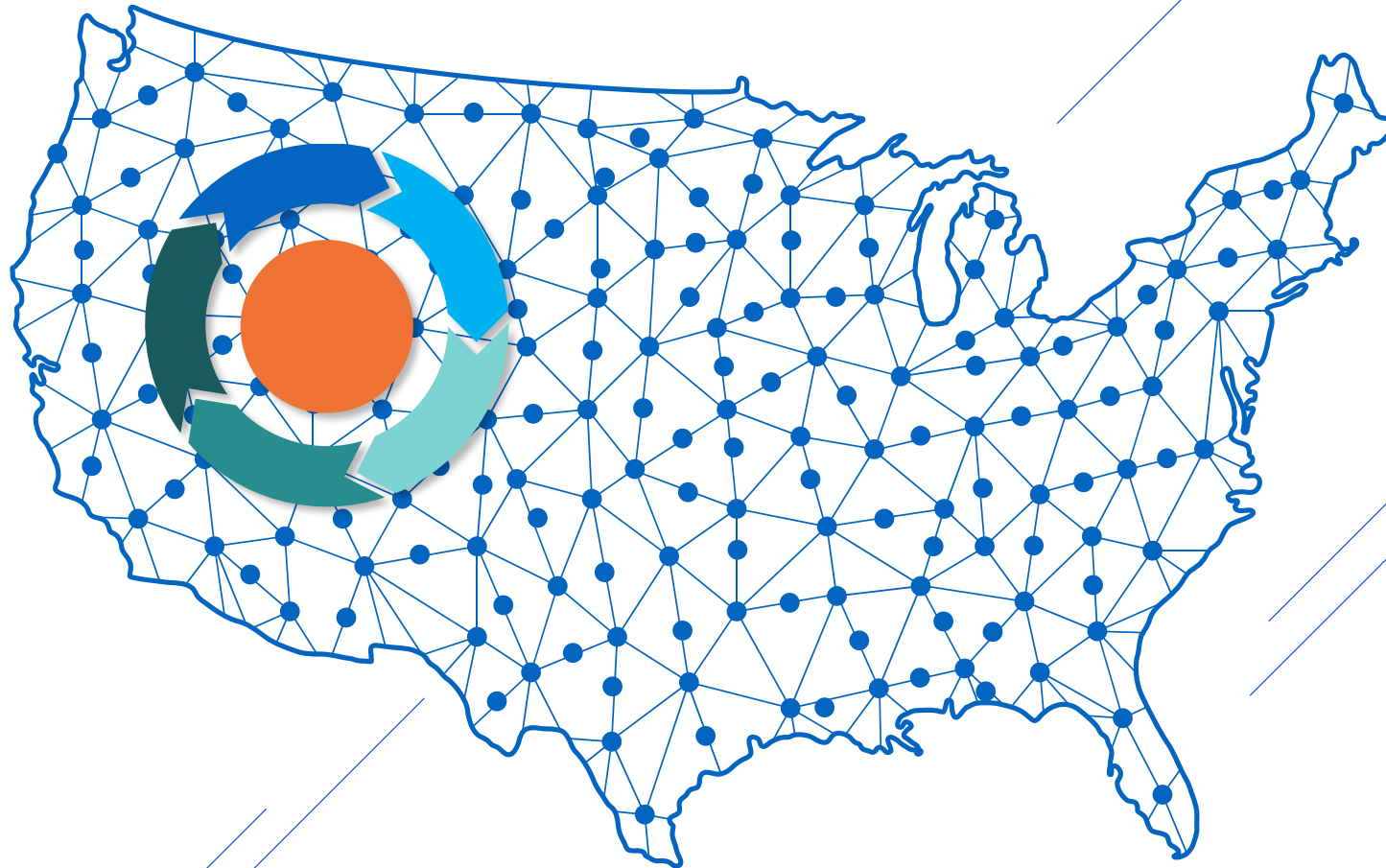
CURRENT STATE

Disconnected and Unidirectional



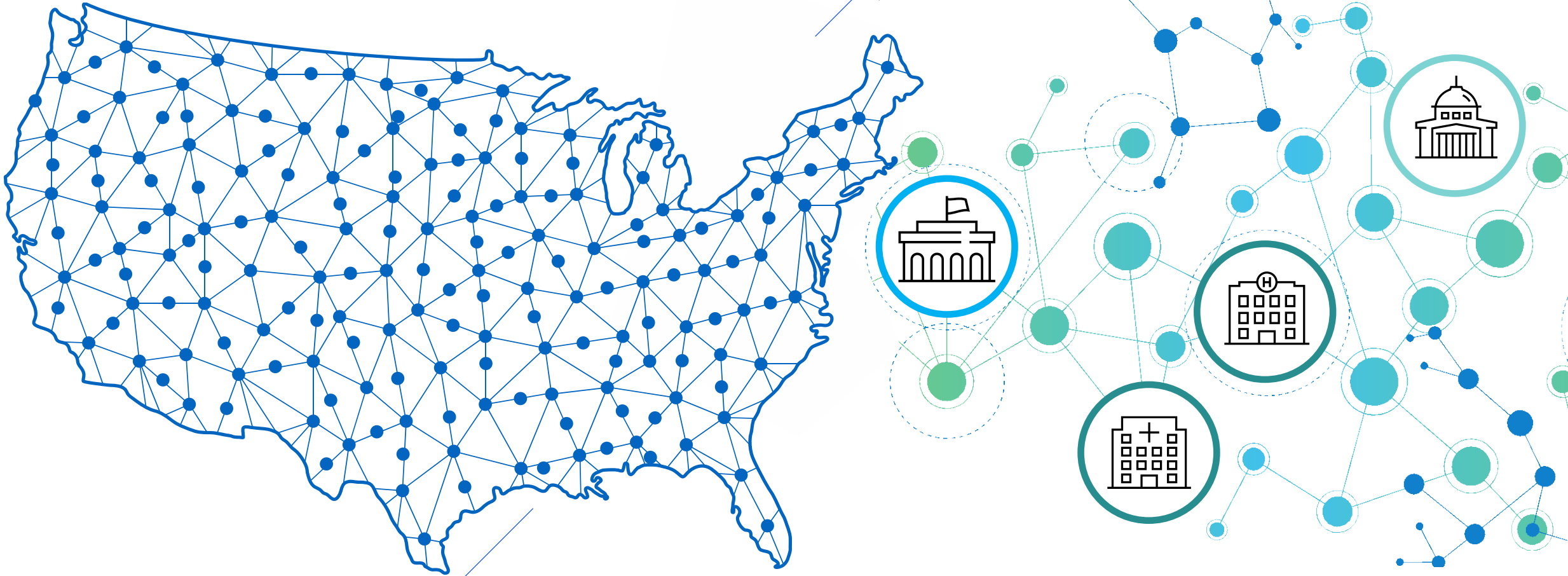
DESIRED FUTURE STATE

Networked and Real-time



DESIRED FUTURE STATE

Networked and Real-time



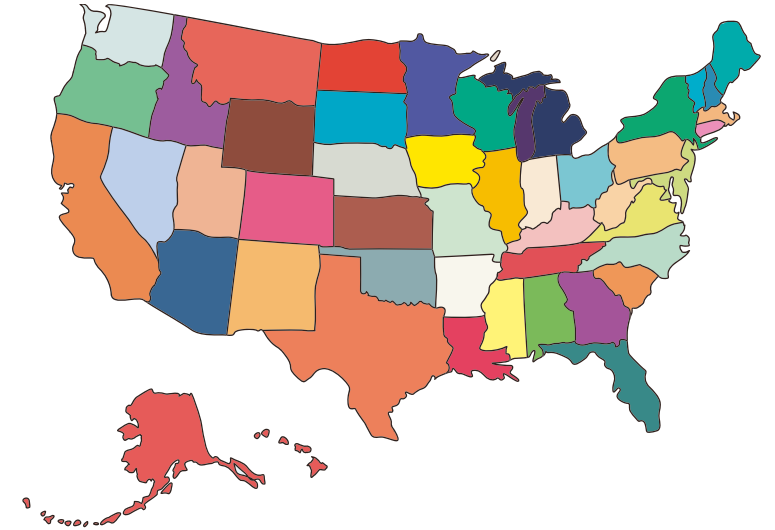
2 Authority Infrastructure

Goal

- Right decisional *authority* at the right *level* with the right *position* under the right *conditions*
- Align the “layered jurisdictional authority” (LJA) of police powers for communicable disease control across all 50 states
- Health officials respond without fear of being fired/ threatened/ defunded

Potential Approach

- Construct current LJA for each state (does not exist)
- Design ideal “future state” LJA
 - Correlates to intelligence platform’s pre-determined threat levels
 - Correlates to operational infrastructure’s pre-determined decision/action levels
 - Nodes may do more, but not less, than the threat level necessitates (*fire analogy*)
 - Carve-out local health officials’ disease control authority from their political hierarchy under conditions of a national security threat
- Explore legislative and regulatory vehicles
 - One federal change vs. 10,000 local/state?



3 Operational Infrastructure

Goal

- Unified command that sits outside political hierarchy with joint decision-making of leaders representing public & private sectors who see “God-view” of intelligence platform and can escalate front-lines response with mutual aid and resources based on pre-determined threat levels
(Analogues: Fire, FEMA, Federal Reserve)

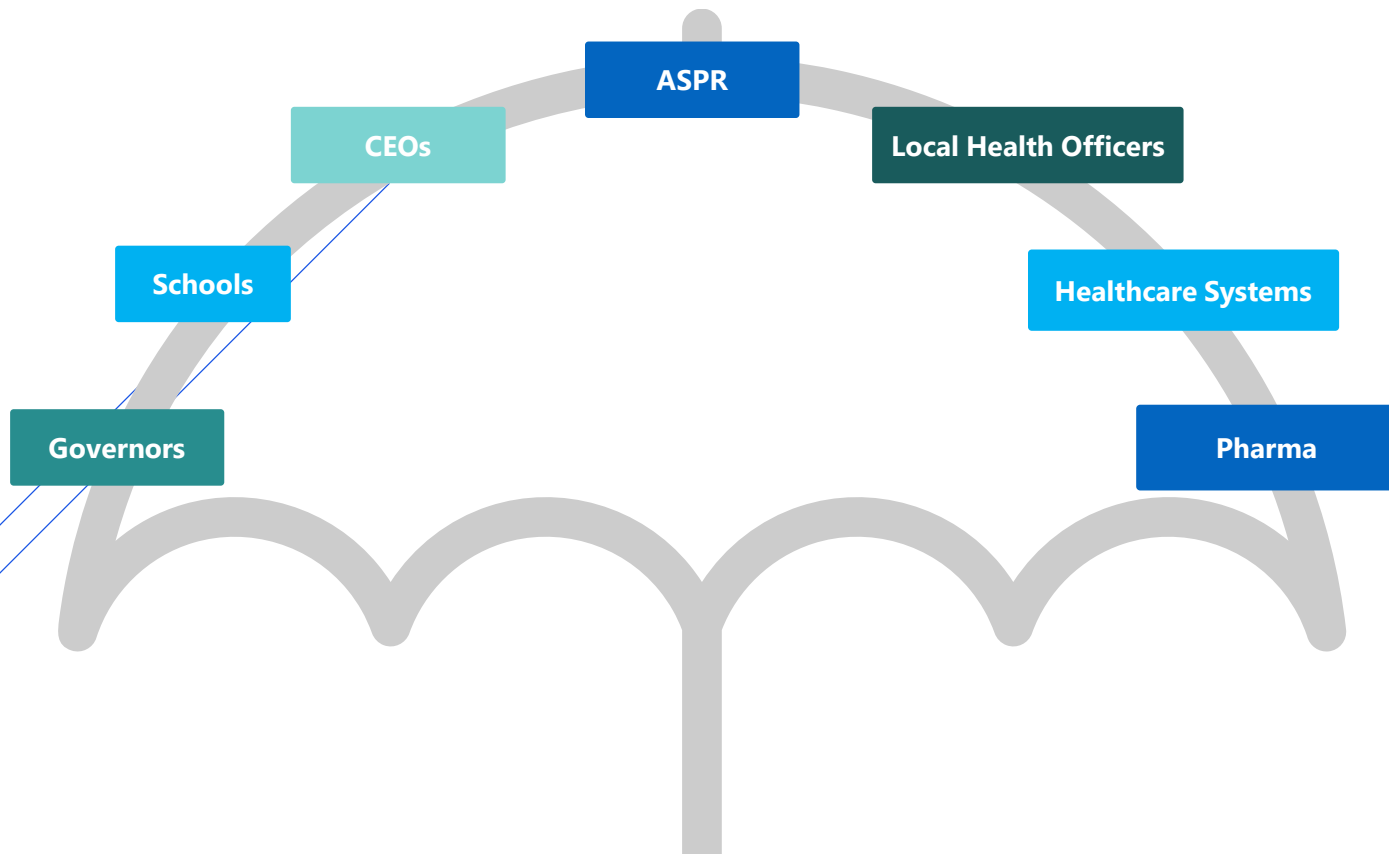
Potential Approach

- Establish umbrella authority to unify all existing components
- Disease Operational Response Authority (DORA)
 - Private sector CEOs (who have a lot to lose by failed containment and/ or participate in containment)
 - Local/state public health
 - ASPR, DHS, DoD
 - Healthcare systems
 - Schools
 - CBOs/ volunteer activation entities

HOW WE GET THERE

3 Operational Infrastructure: Disease Operational Response Authority (DORA)

Analogues: Fire, FEMA, Federal Reserve



Functions

- Politically independent, non-partisan entity
- Accountability for intelligence platform and operational response
- Pre-determined threat levels correlate with minimum operational actions, mutual aid, & resources
- Set of centralized containment capabilities
- Can escalate mutual aid and resources to any local node
- Ongoing; does not need to be assembled amidst a crisis

Considerations

- Creates a body with a lever to pull that is actually attached to something (the intelligence, authority, and operational infrastructures)
- Governance: Balance of power/ checks and balances

4 Trust of the American People

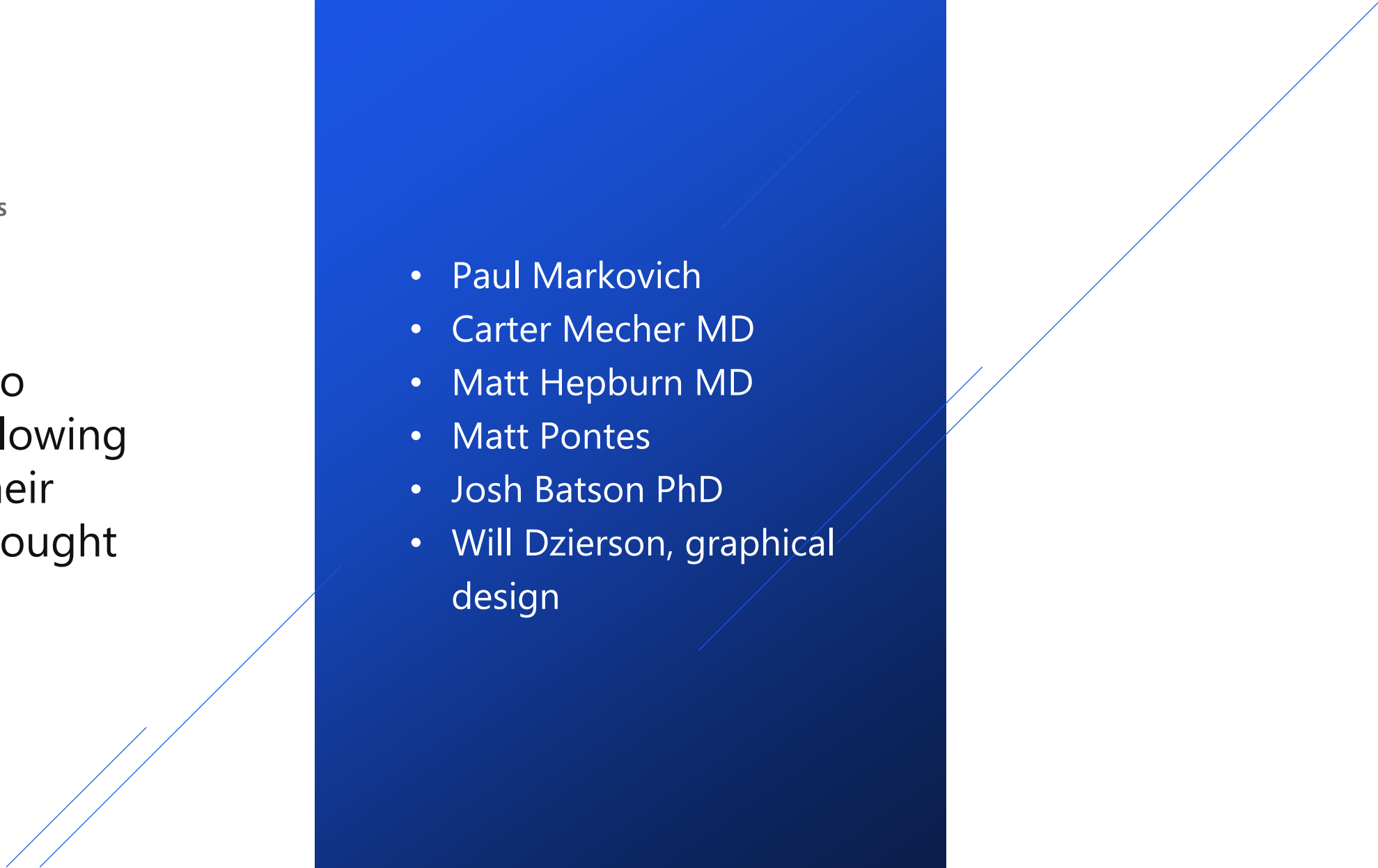
- ***In a democracy***, how do we contain a fast-moving novel pathogen?
- The voluntary participation of every American
 - Example: fire + disaster response
 - The private sector and the American people ran to the fight, but were lacking a General to organize and integrate them into a broader, unified, operational response
- Requires trust of the American people in our response infrastructure, institutions, leaders, and the role of every American when called upon



ACKNOWLEDGEMENTS

Thank you.

I would like to
thank the following
people for their
invaluable thought
partnership:

- Paul Markovich
 - Carter Mecher MD
 - Matt Hepburn MD
 - Matt Pontes
 - Josh Batson PhD
 - Will Dzierson, graphical design
- 



Appendix



The **local public health department** is the party responsible for keeping their community safe...

...and must respond **quickly** to contain disease threats, absent intelligence.

Suspected Disease	Containment Response Time
Ebola	Immediate
Measles	Immediate
Tuberculosis	Immediate
Meningitis	Immediate
Rabies	Immediate
Vaping lung injury	Immediate
COVID-19 (early 2020)	Immediate
Zika	Same day
Foodborne disease	Same day
Hepatitis A	Several days
Hepatitis B	Same week
HIV	Same week

The CDC collects,
quantifies, and analyzes the
data being reported from
states...

... but is **slow** to respond
with actionable reports and
guidance.

Actual Outbreak	Time to Report/ Guidance
2015 Ebola (guidance)	5 months
2019 Measles Outbreak (report)	8 months
Tuberculosis Outbreak (report)	1 year
2014 College Meningitis (guidance)	>2 years
Rabies high risk incident (report)	5 months
2019 Vaping Lung Injury (report + guidance)	4 months
COVID-19 (early 2020)	2-16 months¹
Zika (early guidance)	1 month
Foodborne Disease (report)	2 months
Hepatitis A Outbreak (report)	4 months

1) ~2 months (February 2020) to identify "pandemic potential," ~9 months (September 2020) to issue guidance that COVID-19 is airborne and ~16 months (May 2021) to announce that COVID-19 is not spread on surfaces.