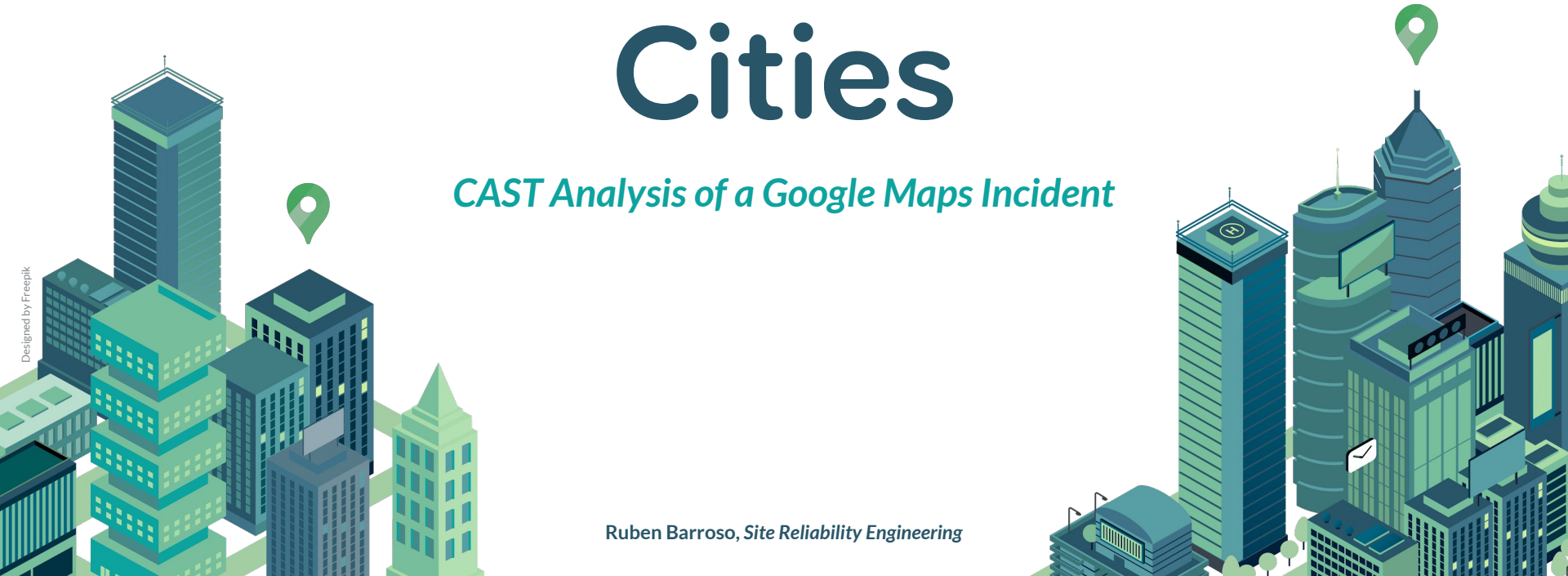


The Case of the Misnamed Cities

CAST Analysis of a Google Maps Incident

Ruben Barroso, *Site Reliability Engineering*

Designed by Freepik



Agenda

- The Incident
- Root Cause Analysis
- Accident Models
- CAST
- RCA vs CAST
- Takeaways
- Resources

The Incident



r/GoogleMaps · 8 mo. ago



Why is Google Maps showing "(balance)" next to some cities and referring to them as metro areas?

[Here](#) is a screenshot of what I'm talking about. Never seen this until today. A glitch?



25



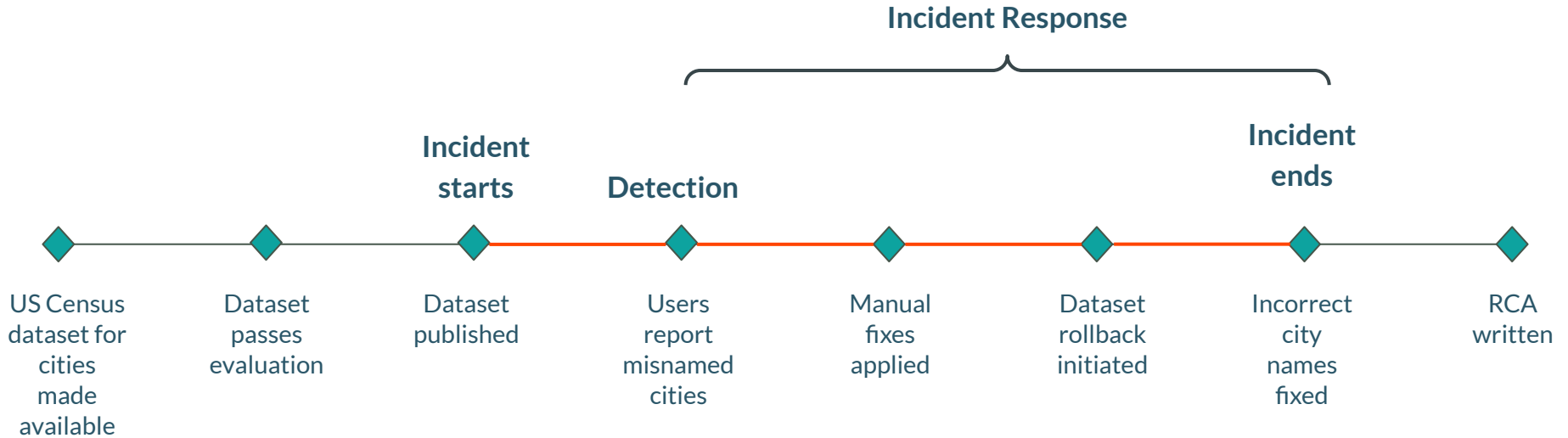
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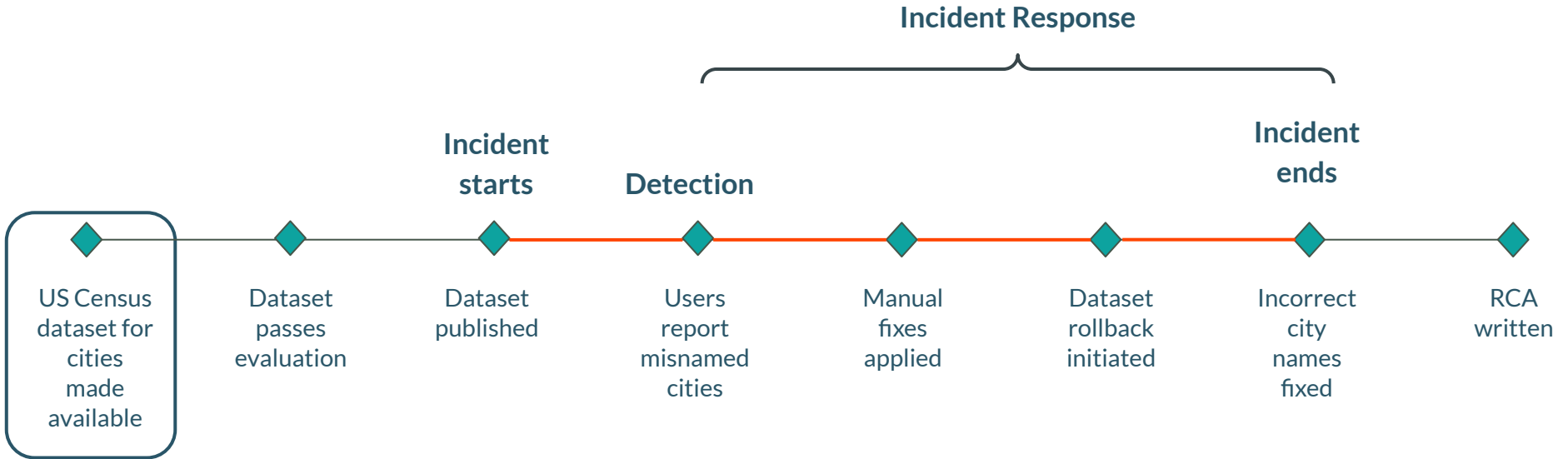
Share



Order of Events



Order of Events

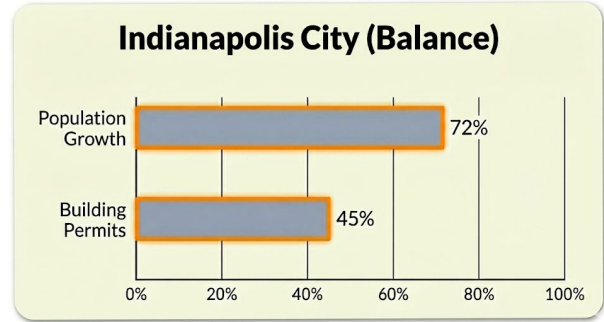


Why "(balance)"?

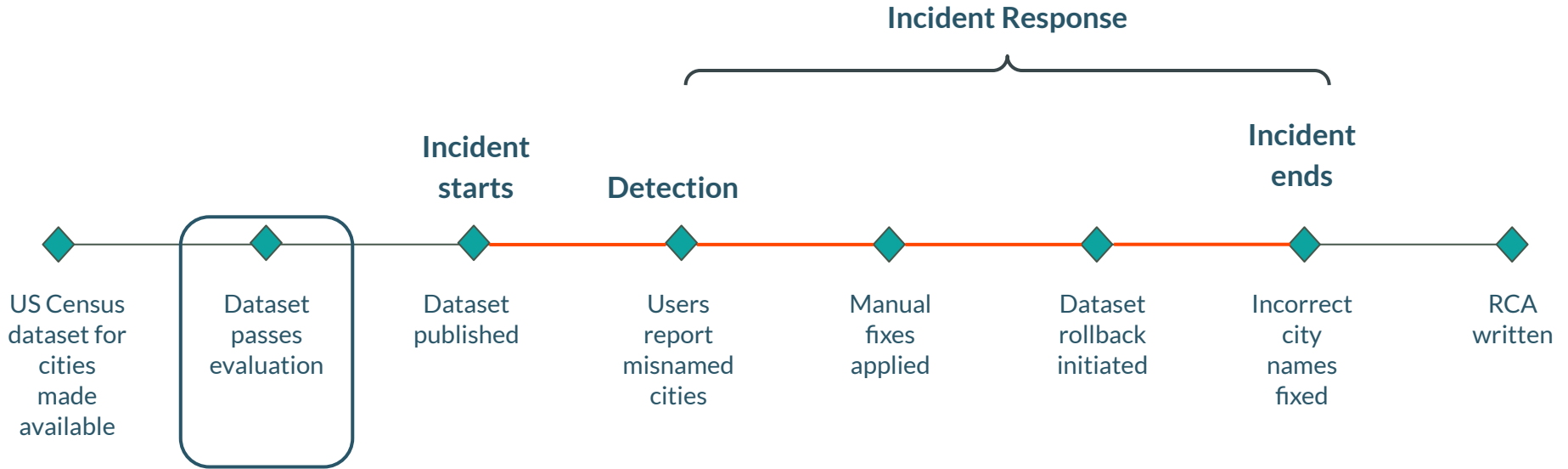


Indianapolis

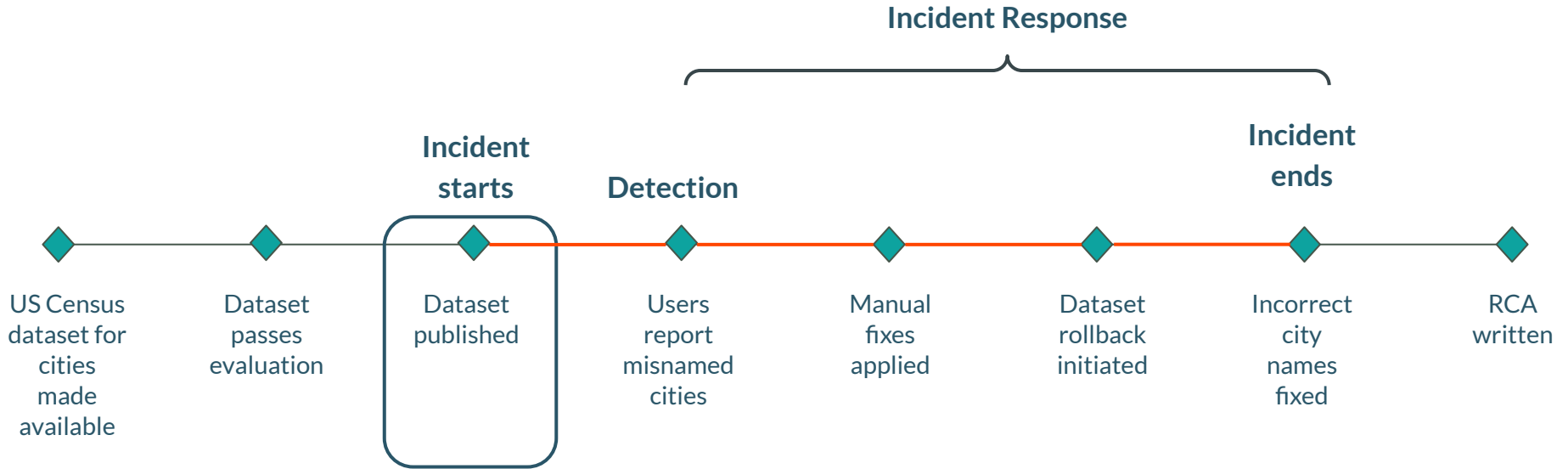
Indianapolis city (balance)



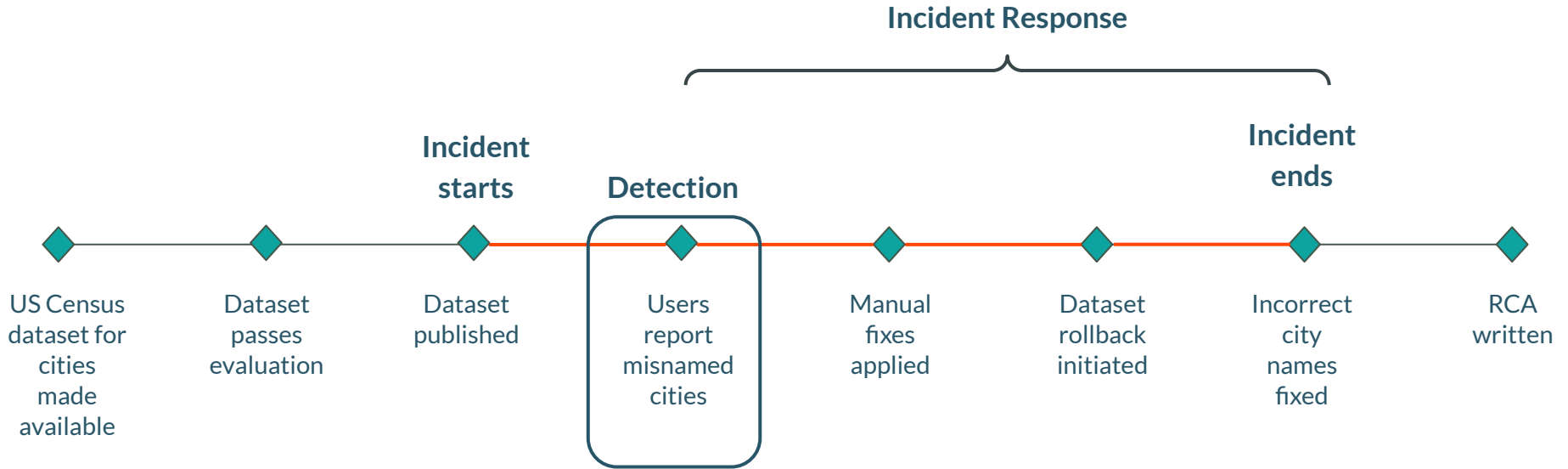
Order of Events



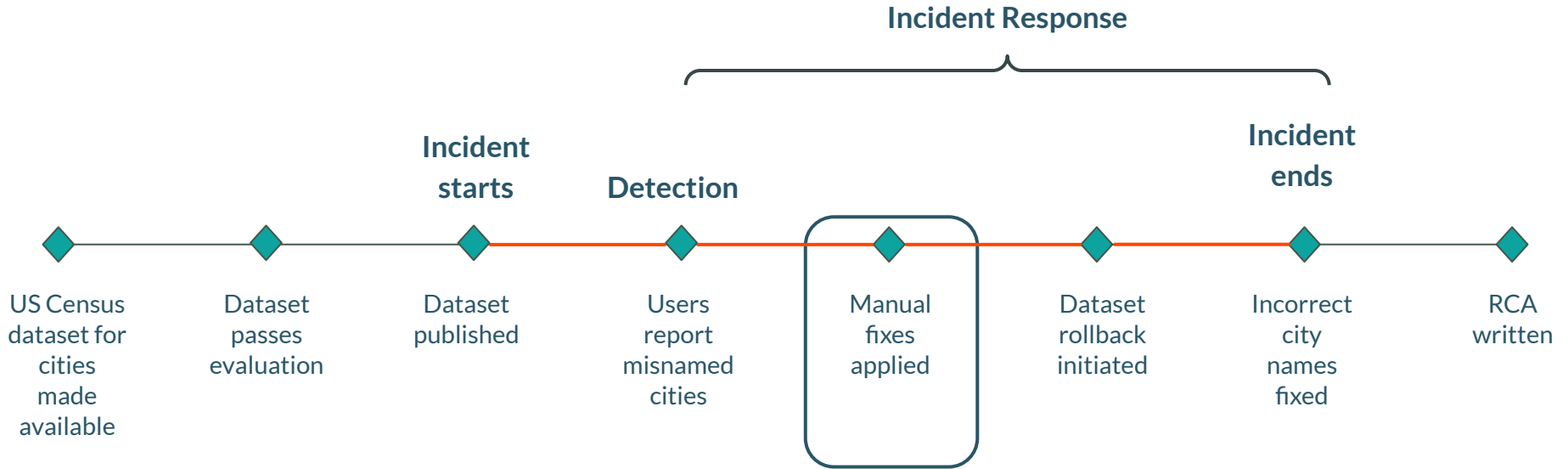
Order of Events



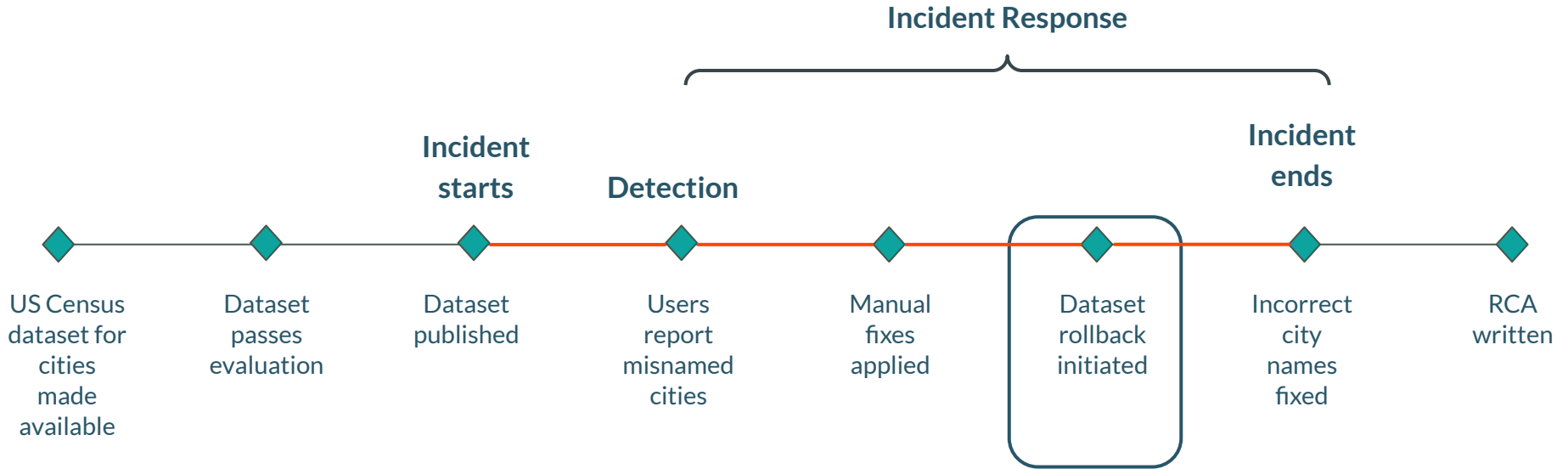
Order of Events



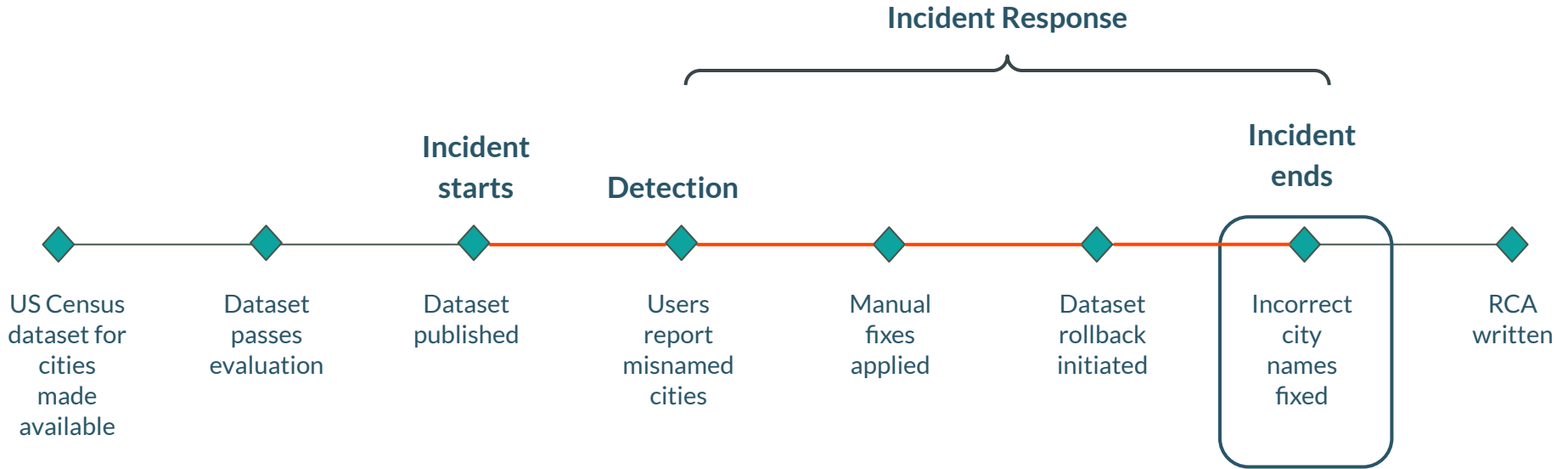
Order of Events



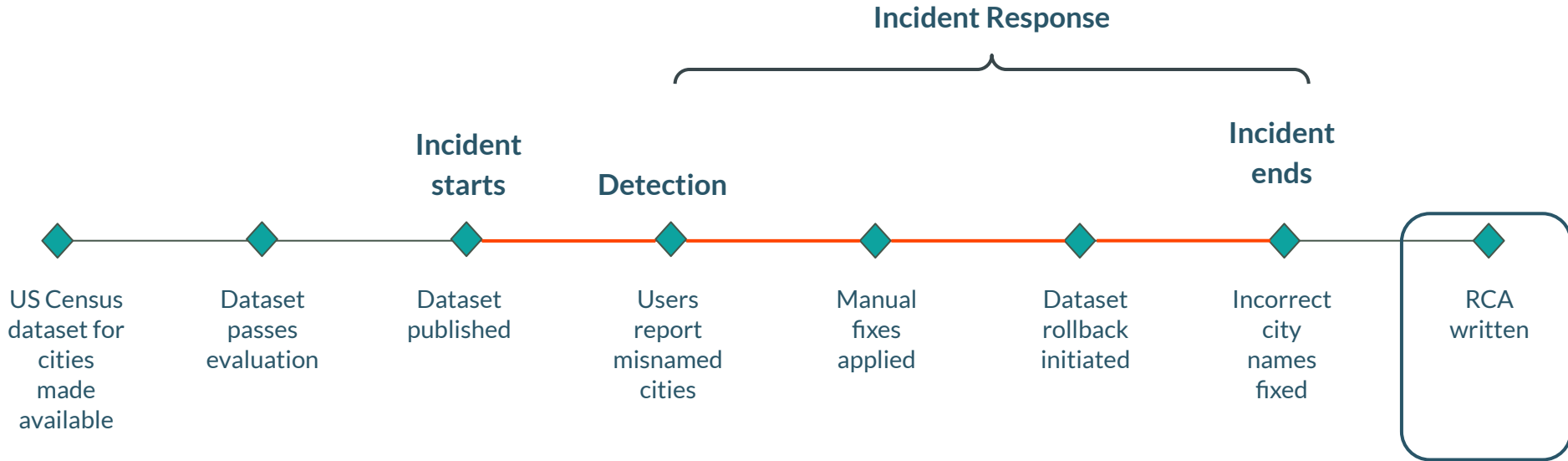
Order of Events



Order of Events



Order of Events



Root Cause Analysis

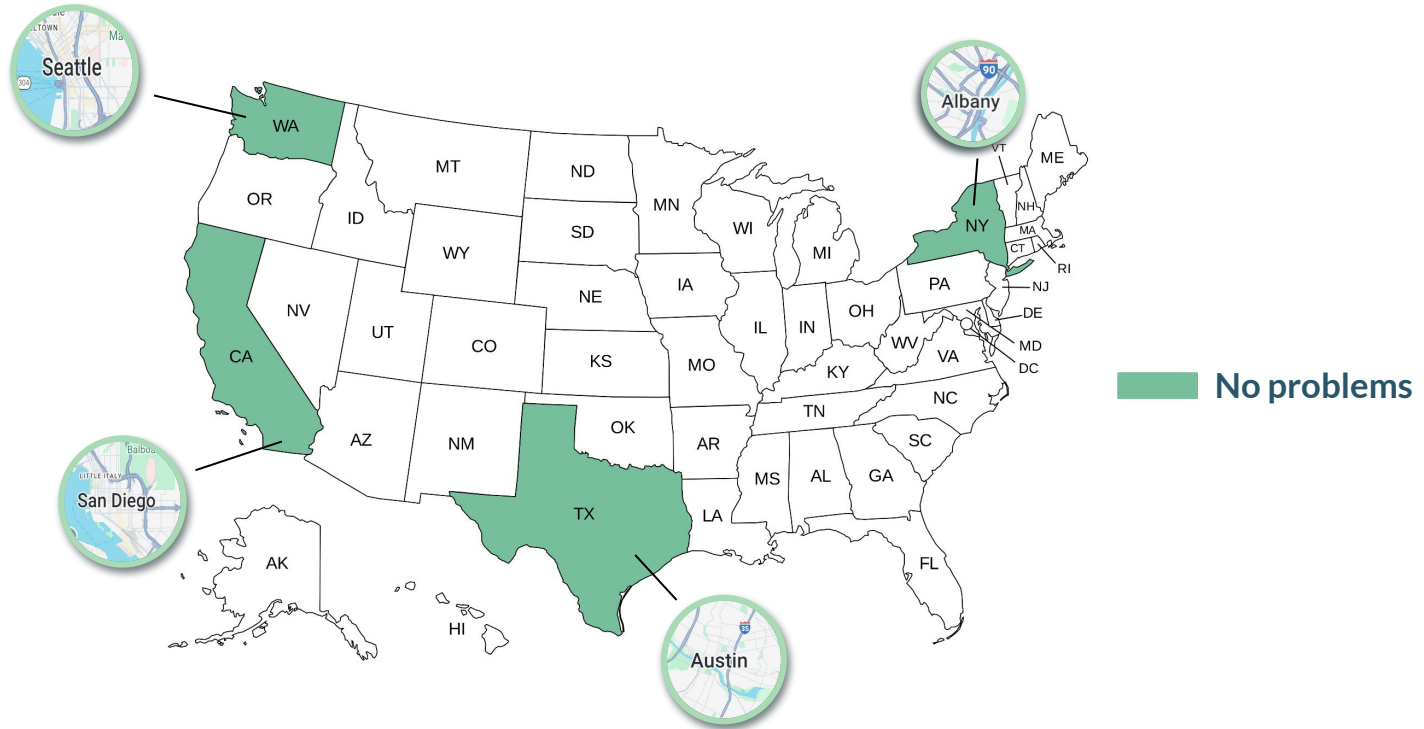
Evaluation Tool



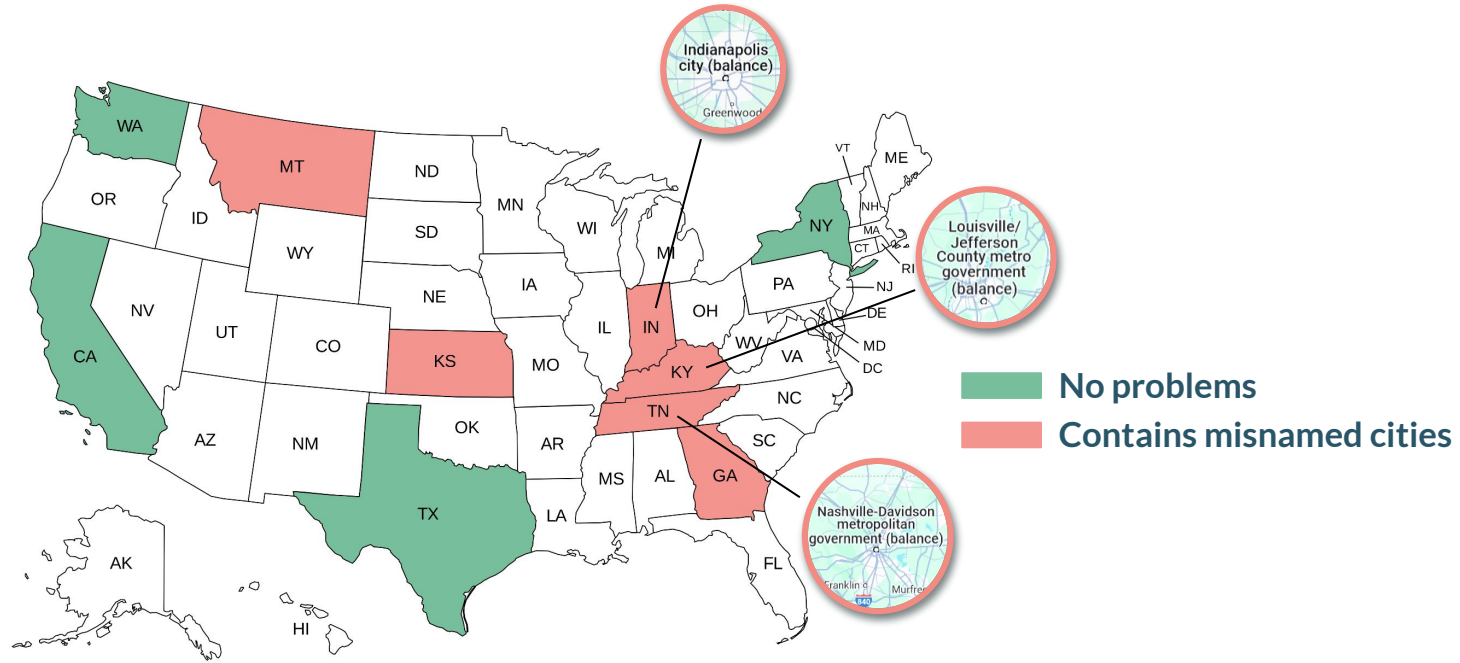
US Census Data for All 50 States



No Problems in 4 States



Misnamed Cities in 6 States

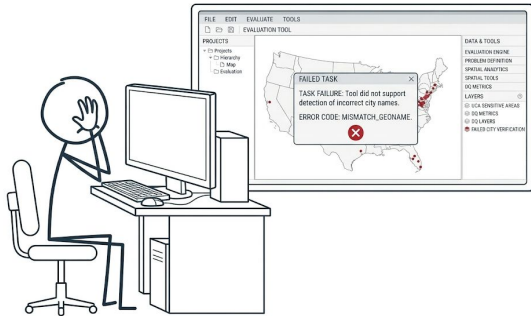


1st Root Cause: Limited Evaluation Tool



Evaluation tool didn't support detection of incorrect city names.

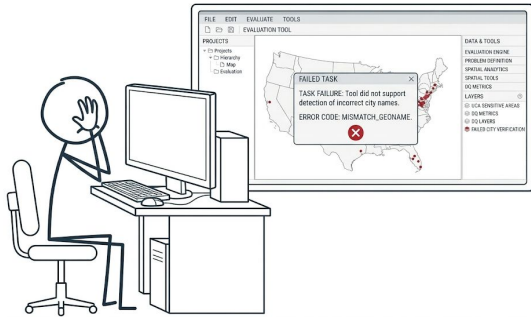
1st Root Cause: Action Items



- Automate the detection of naming issues in cities

Evaluation tool didn't support detection of incorrect city names.

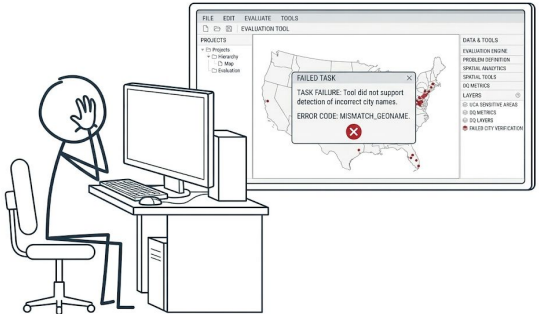
1st Root Cause: Action Items



- Automate the detection of naming issues in cities
- Write instructions on how to enable specific checks in the tooling

Evaluation tool didn't support detection of incorrect city names.

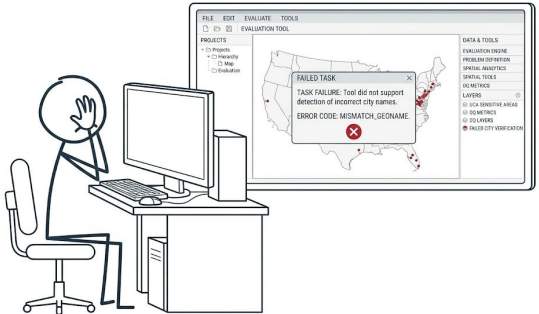
1st Root Cause: Action Items



- Automate the detection of naming issues in cities
- Write instructions on how to enable specific checks in the tooling
- Flag special characters such as “ / (:

Evaluation tool didn't support detection of incorrect city names.

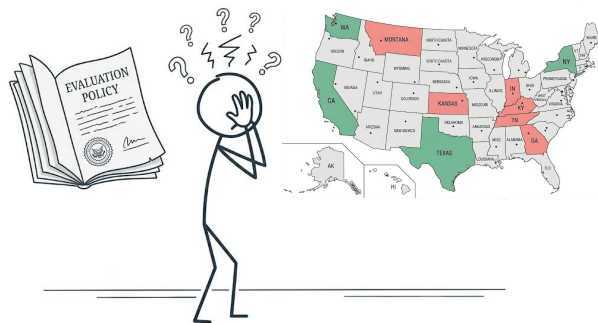
1st Root Cause: Action Items



- Automate the detection of naming issues in cities
- Write instructions on how to enable specific checks in the tooling
- Flag special characters such as " / (:
- Programmatic checks to block publication of large datasets that contain naming issues

Evaluation tool didn't support detection of incorrect city names.

2nd Root Cause: Ad-hoc Sampling of States



Import policy didn't specify a sampling strategy.

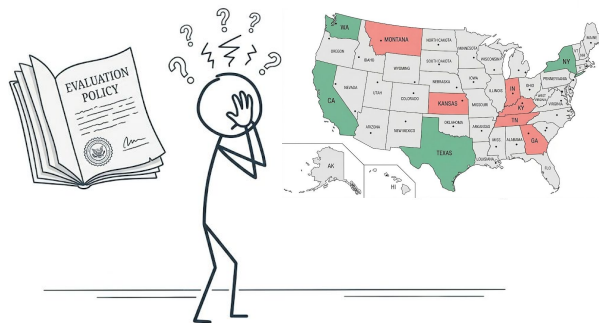
2nd Root Cause: Action Items

US Census dataset for cities made available

Dataset passes evaluation

Dataset published

Users report misnamed cities



- Evaluate prominent cities, like: Indianapolis, Nashville, etc.
- Codify a process for flagging substantial differences in city names and send those for manual review

Import policy didn't specify a sampling strategy.

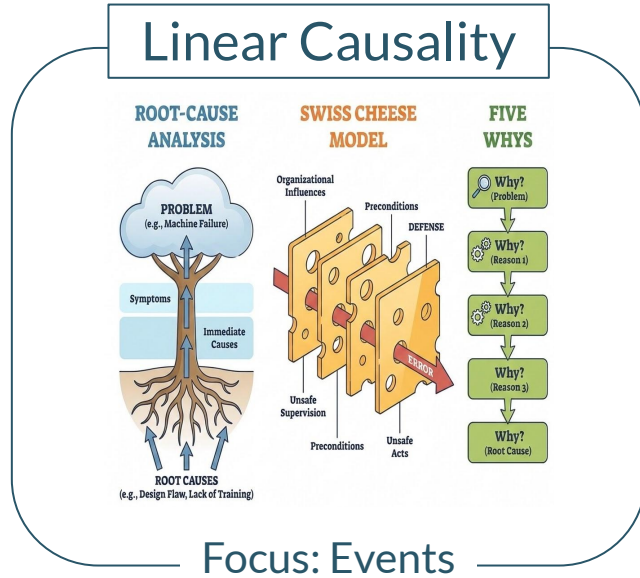
Accident Models

Accident Models

Why do incidents happen?

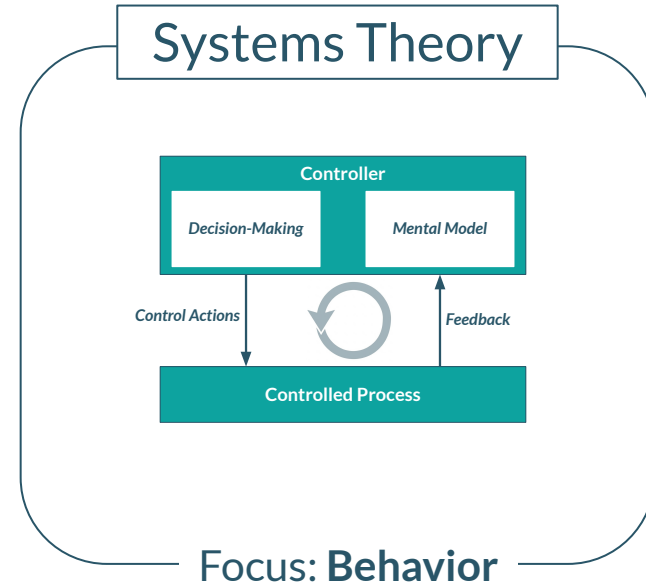
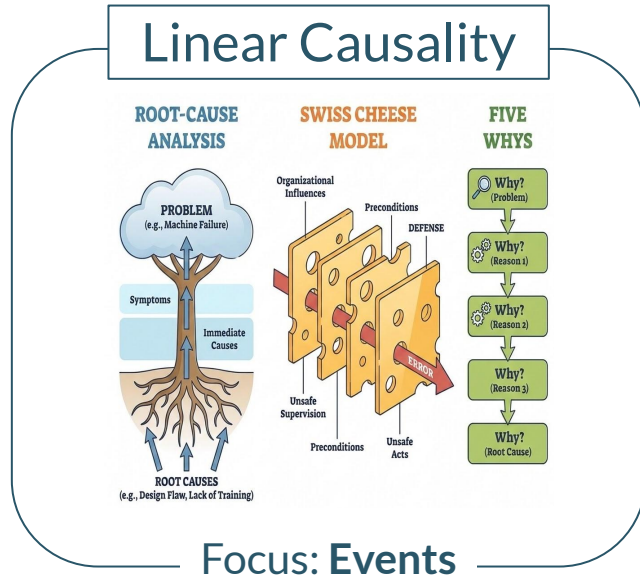
Linear Causality

Why do incidents happen?



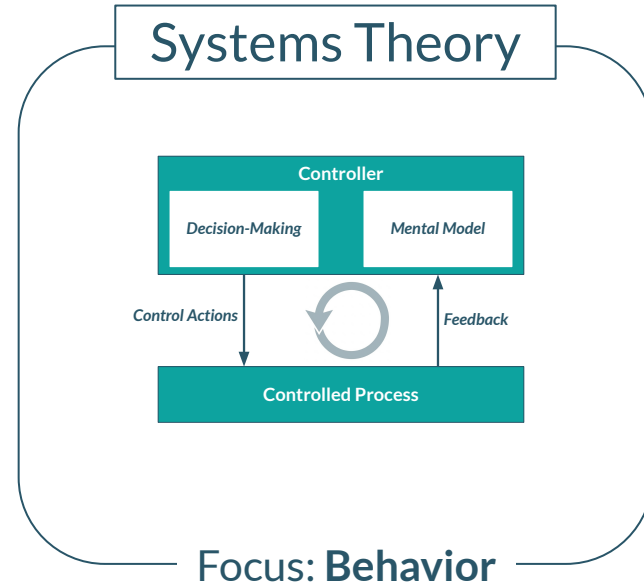
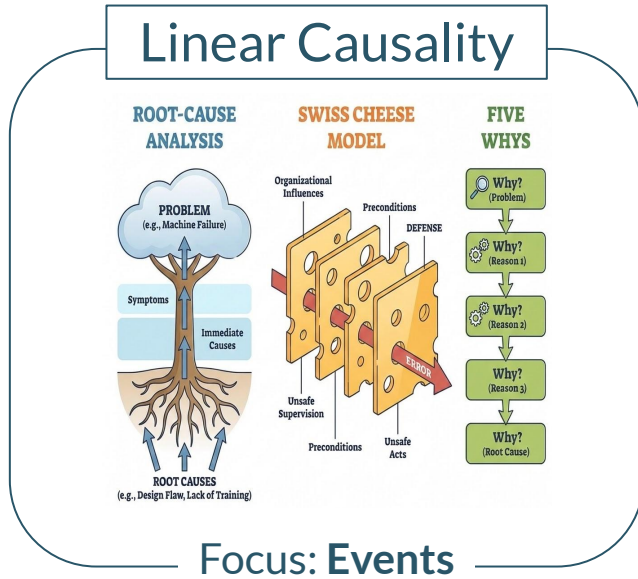
Control-Feedback Loops

Why do incidents happen?



Incident Prevention

Why do incidents happen?



How do we prevent incidents?

Chronology != Causality



Chronology != Causality



Chronology != Causality

Assumption:

IF Geospecialists identify states containing misnamed cities THEN
dataset with misnamed cities does NOT pass evaluation



Chronology != Causality

Assumption:

IF Geospecialists identify states containing misnamed cities THEN
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Chronology != Causality

Assumption:

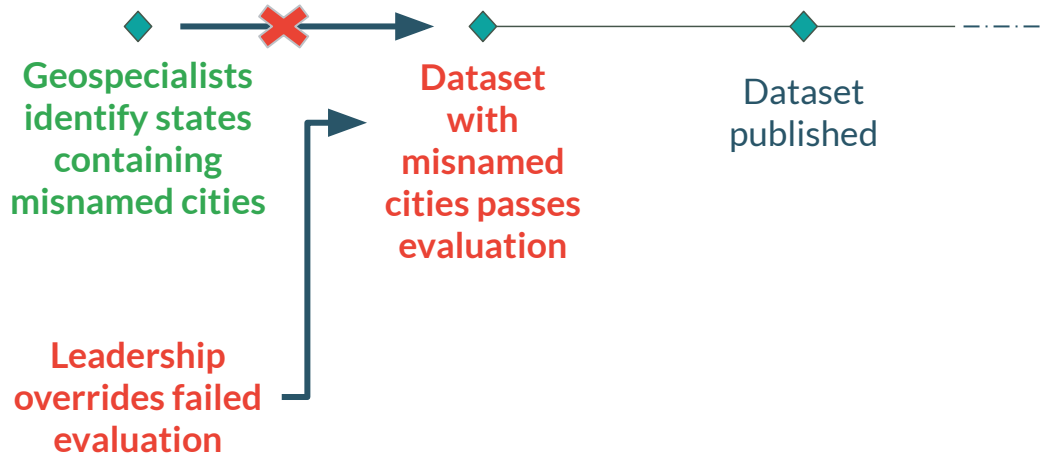
IF Geospecialists identify states containing misnamed cities THEN
dataset with misnamed cities does NOT pass evaluation



Chronology != Causality

Assumption:

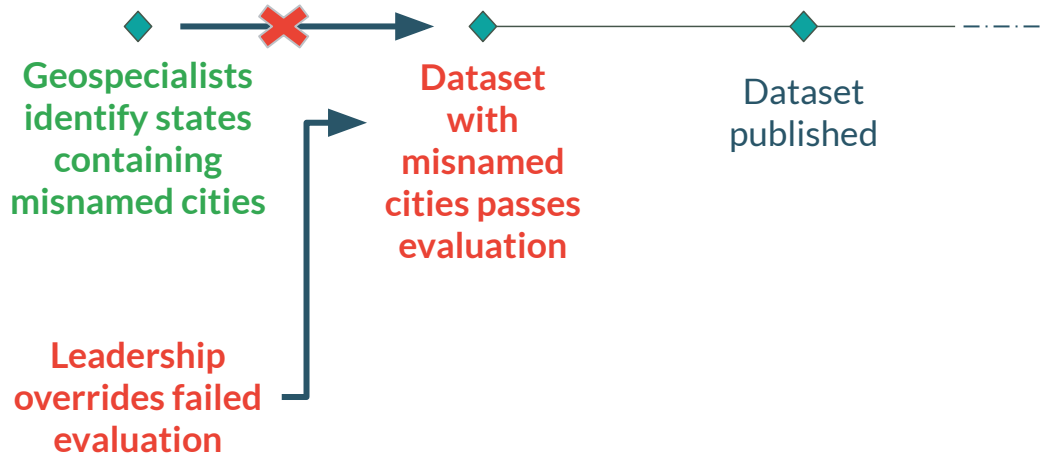
IF Geospecialists identify states containing misnamed cities THEN
dataset with misnamed cities does NOT pass evaluation



Chronology != Causality

Assumption:

IF Geospecialists identify states containing misnamed cities THEN dataset with misnamed cities does NOT pass evaluation



Subjective Selection of Events



Subjective Selection of Events



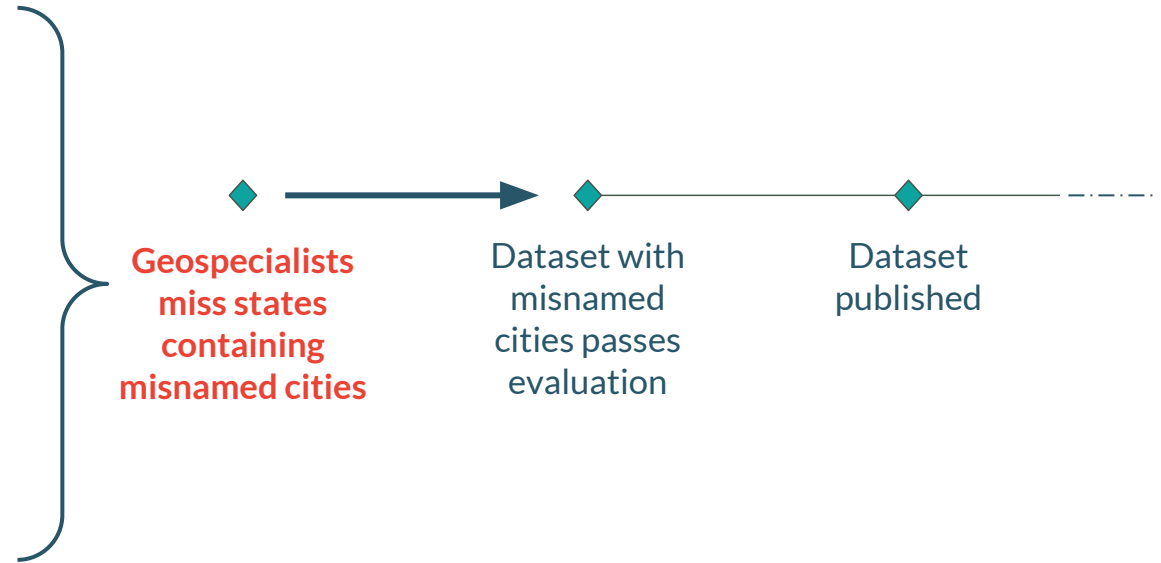
Subjective Selection of Events



Subjective Selection of Events



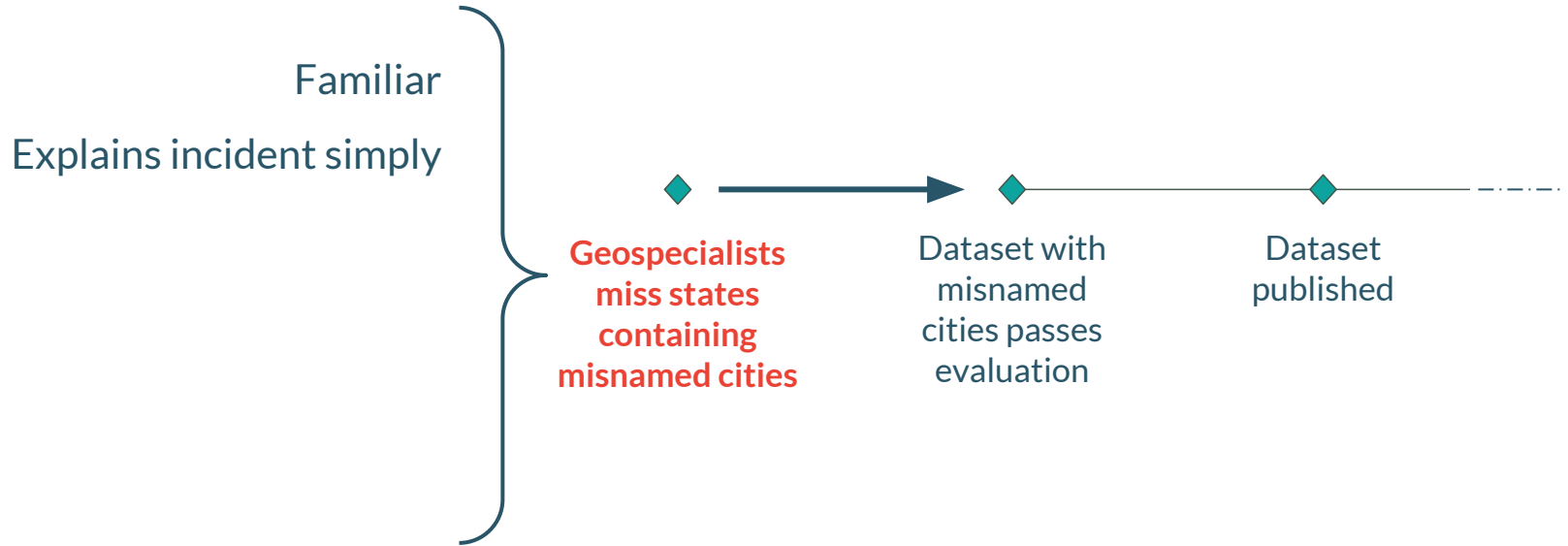
Subjective Selection of Events



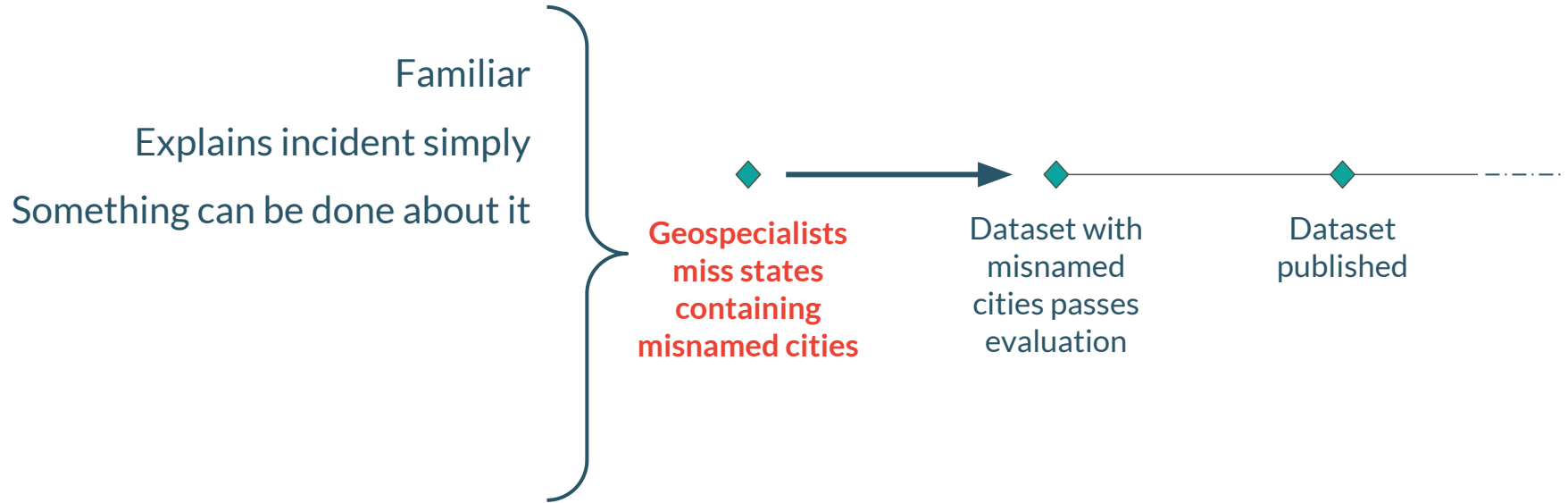
Subjective Selection of Events



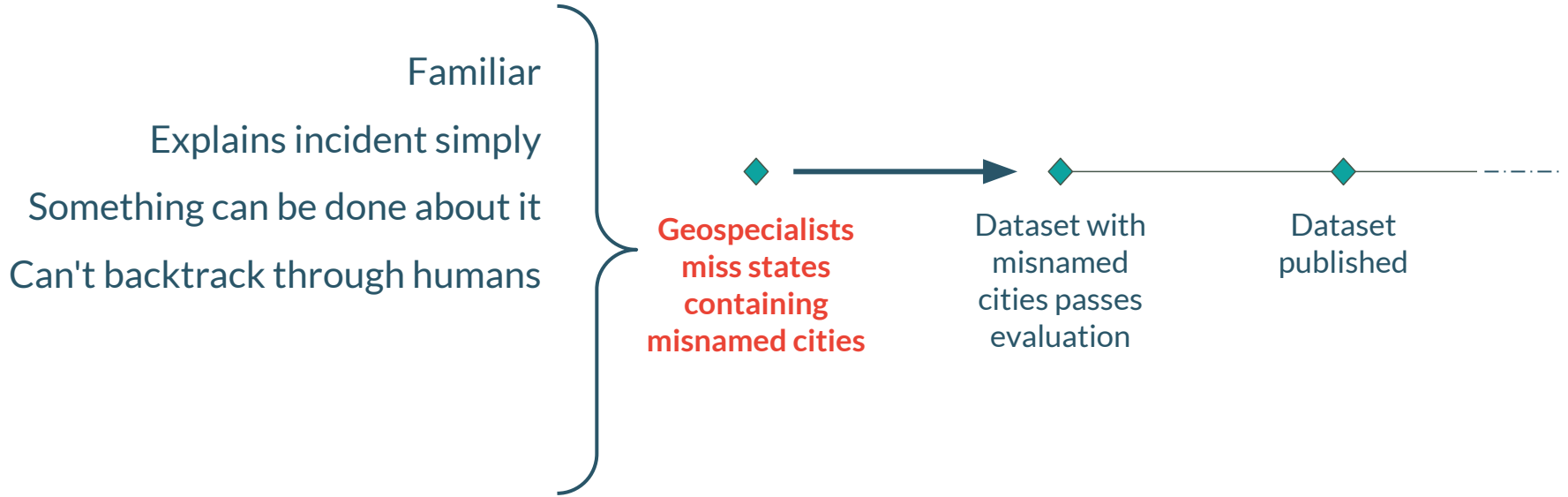
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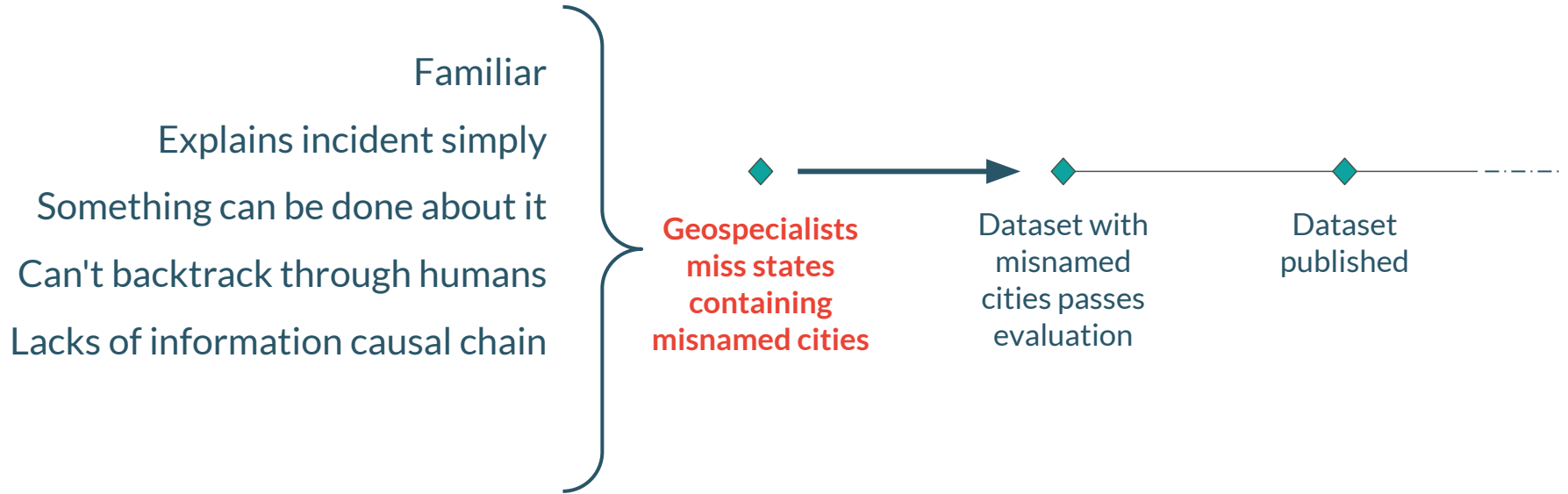
Subjective Selection of Events



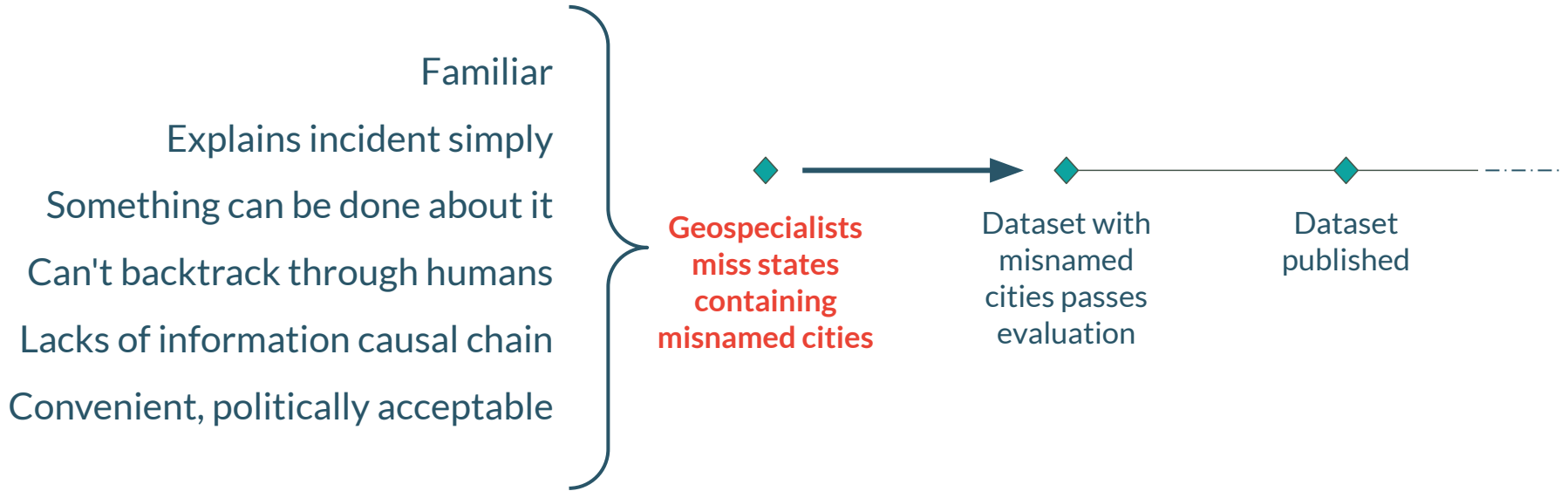
Subjective Selection of Events



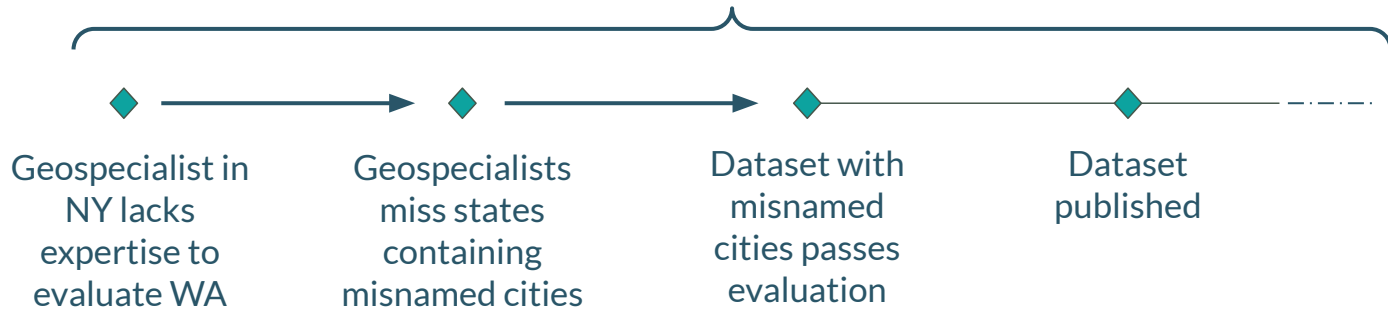
Subjective Selection of Events



Subjective Selection of Events

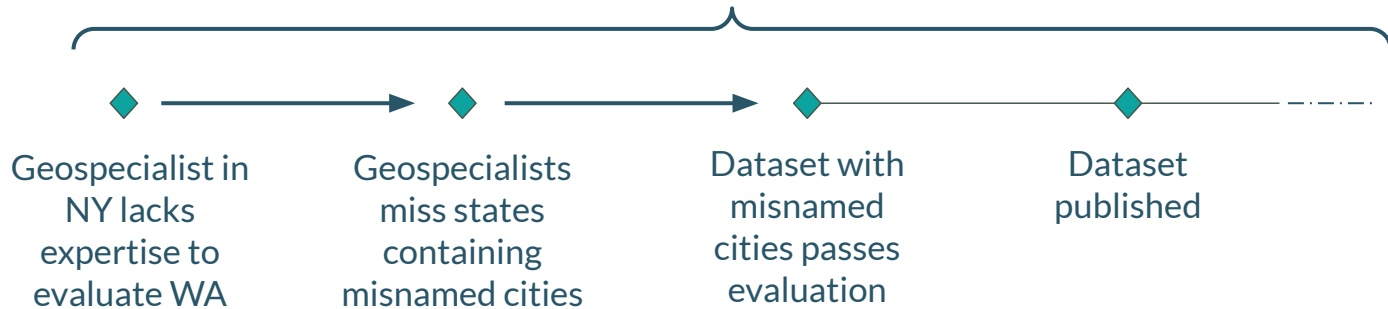


Systemic Factors: Non-events



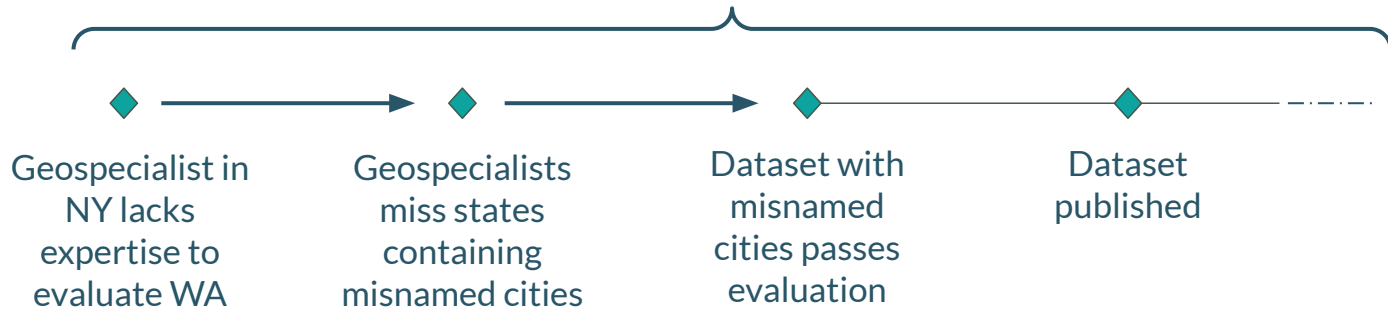
Systemic Factors: Non-events

Decision-making of management



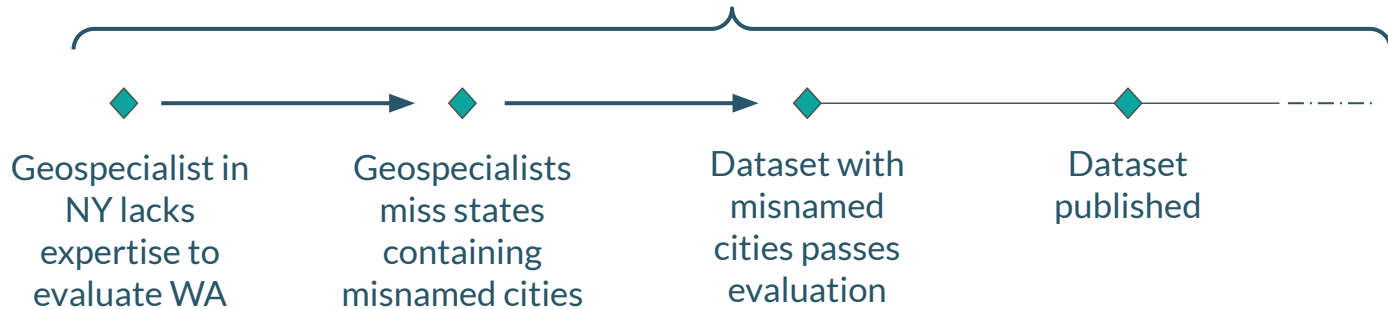
Systemic Factors: Non-events

Decision-making of management
Safety culture



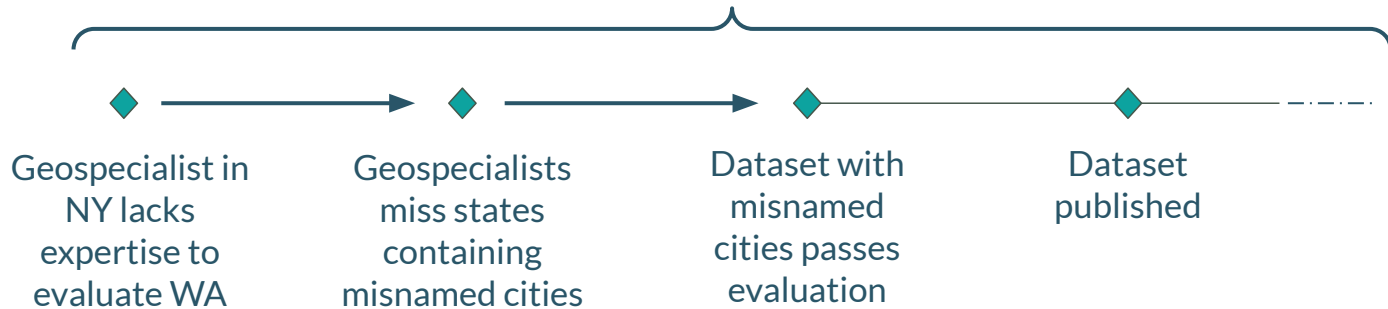
Systemic Factors: Non-events

Decision-making of management
Safety culture
Management of change (MoC)

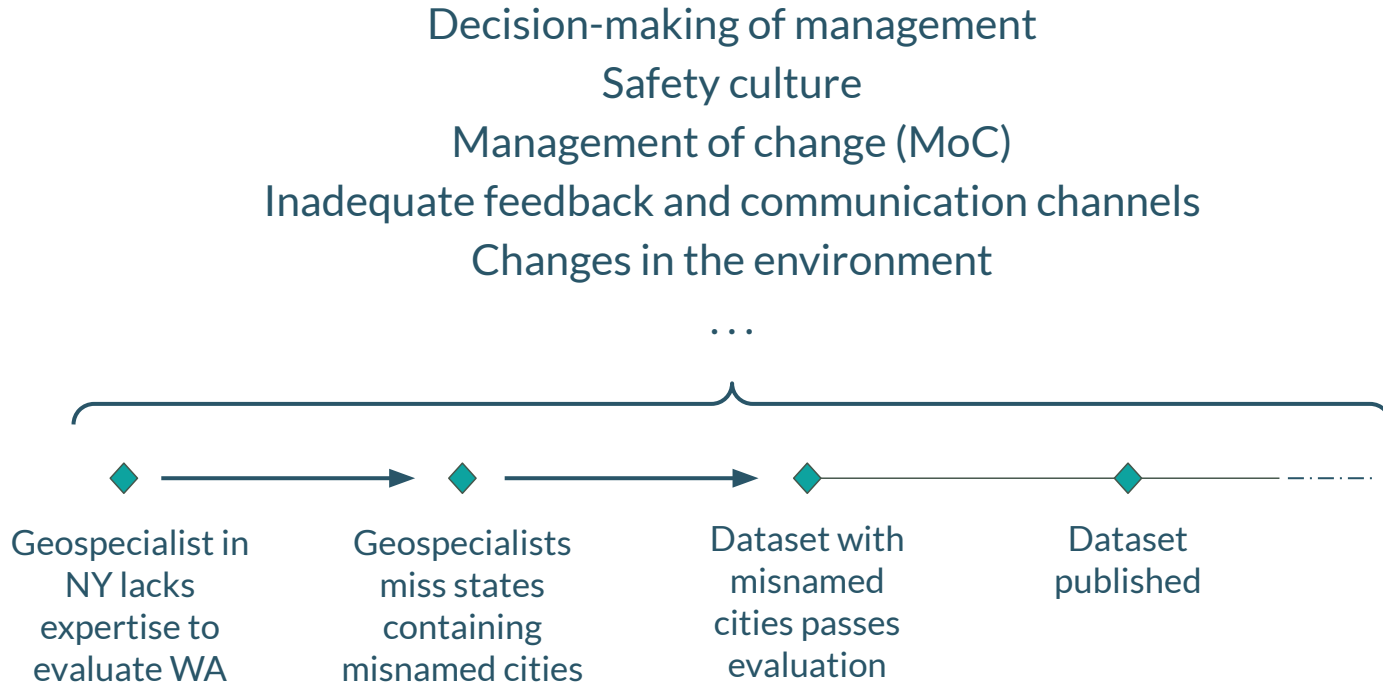


Systemic Factors: Non-events

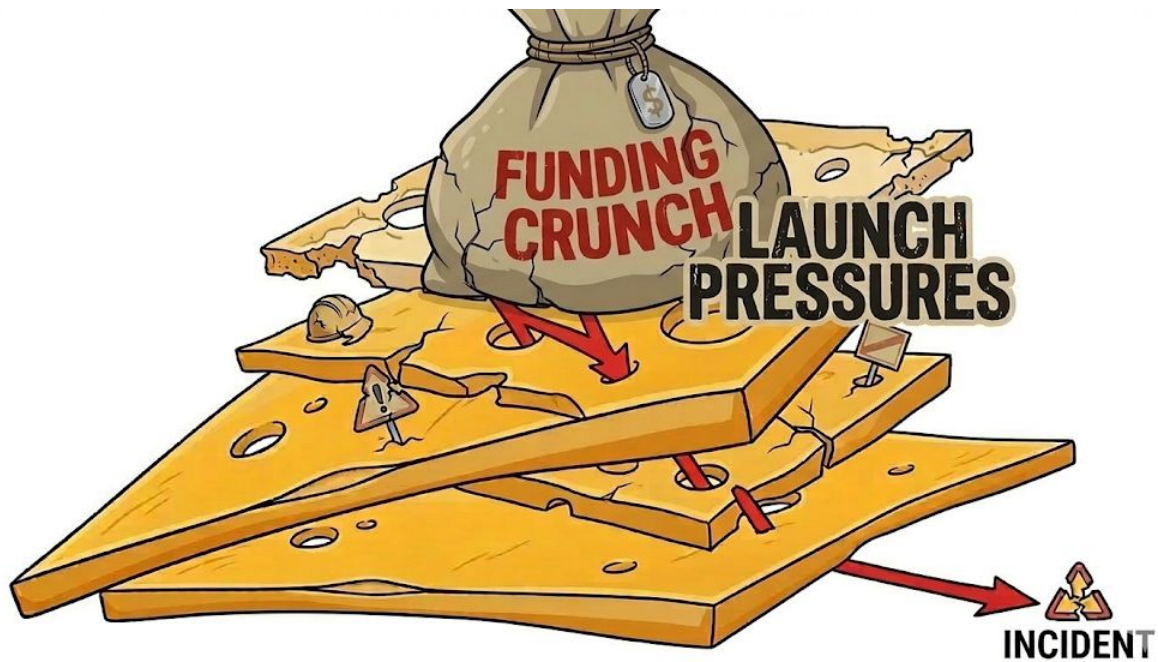
Decision-making of management
Safety culture
Management of change (MoC)
Inadequate feedback and communication channels



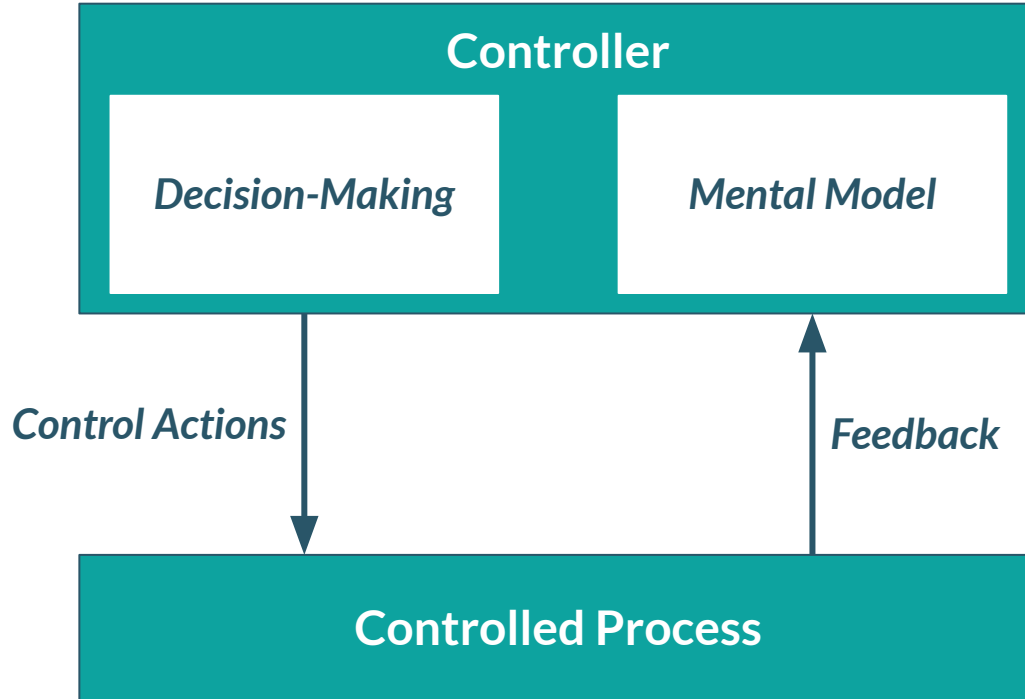
Systemic Factors: Non-events



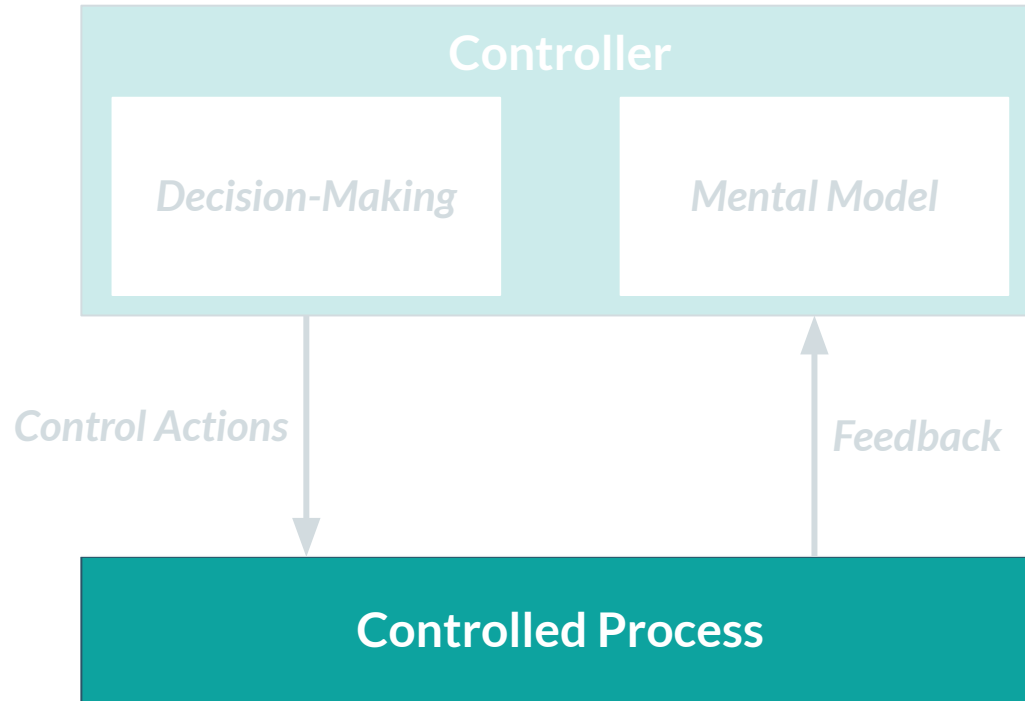
Systemic Factors: Non-events



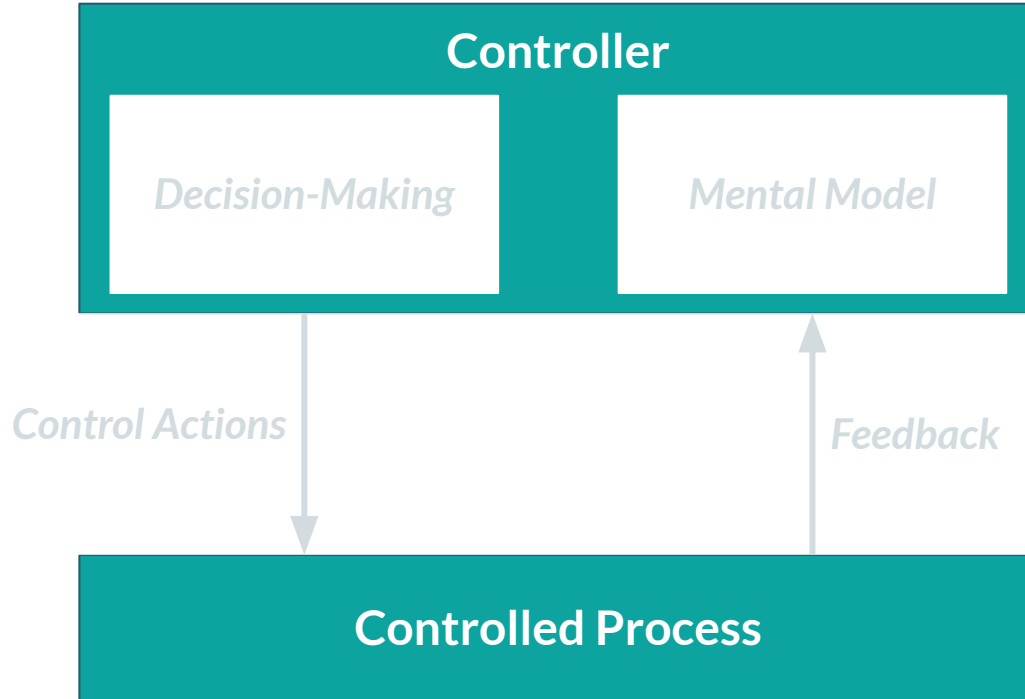
Control View of Causality



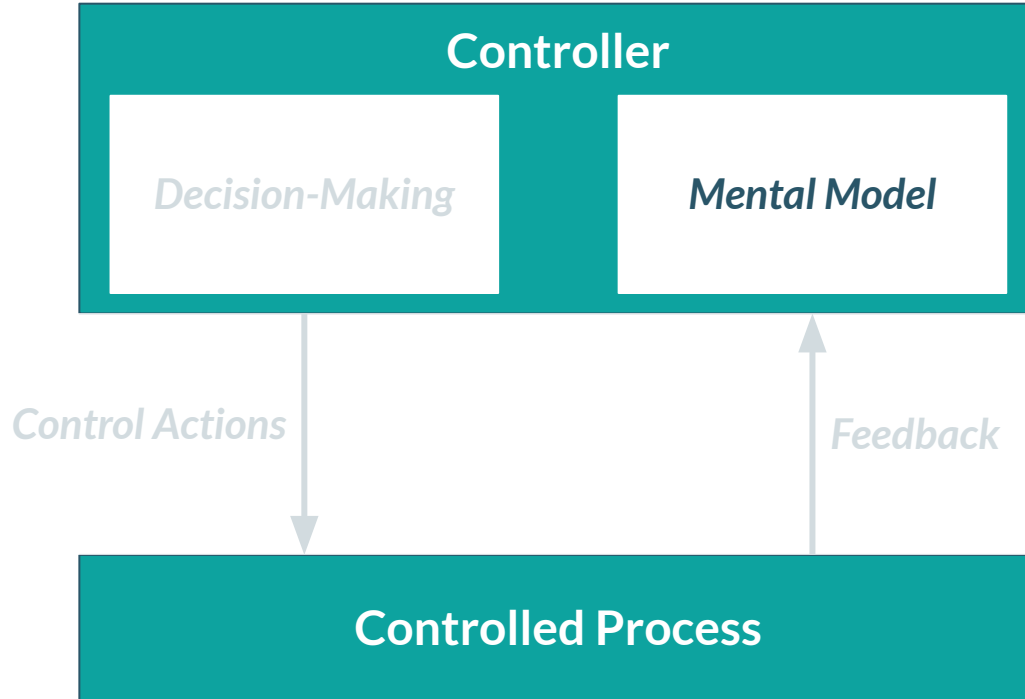
Control-Feedback Loop



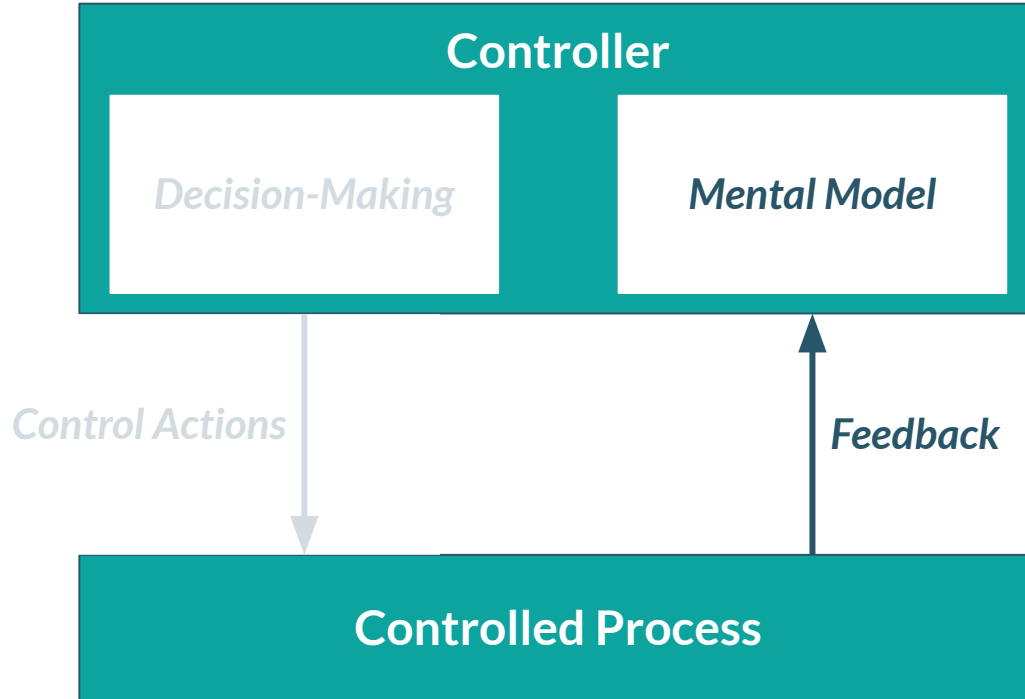
Control-Feedback Loop



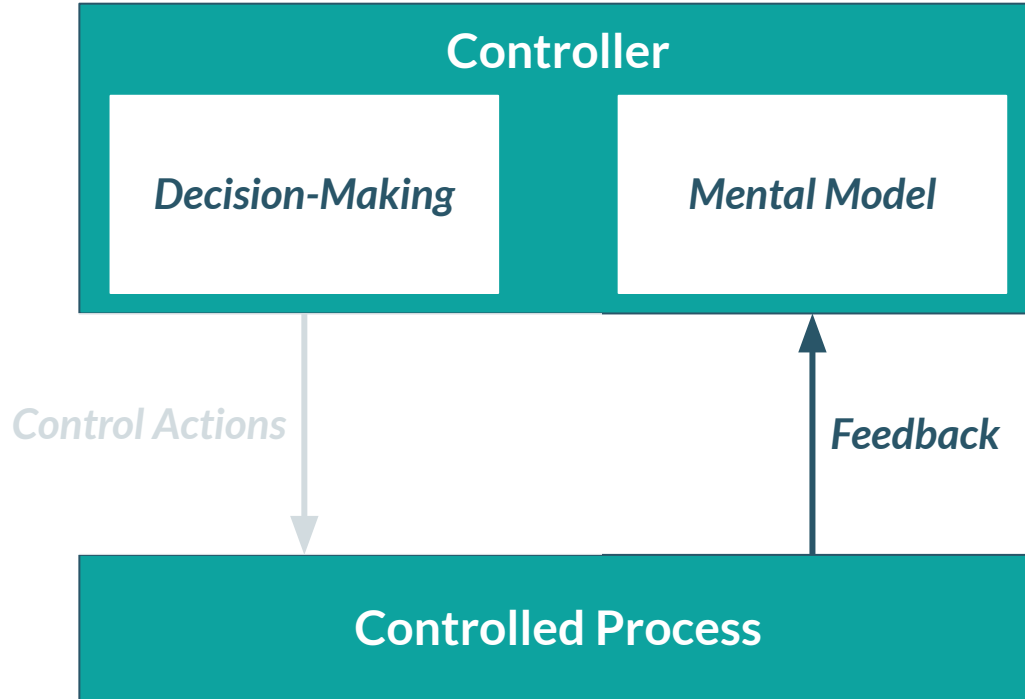
Control-Feedback Loop



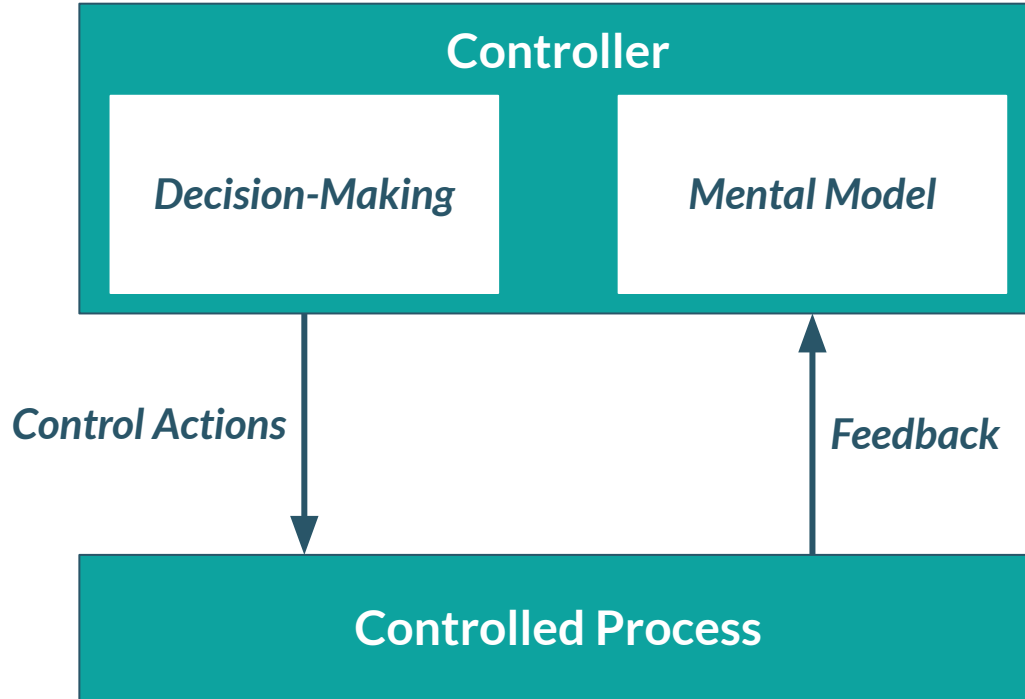
Control-Feedback Loop



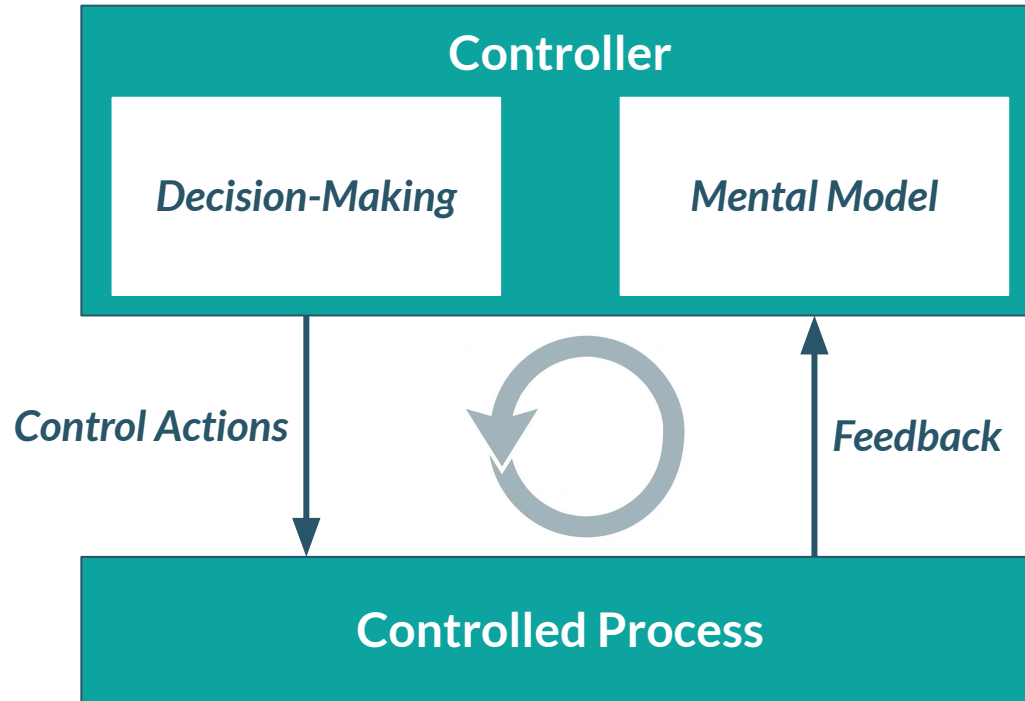
Control-Feedback Loop



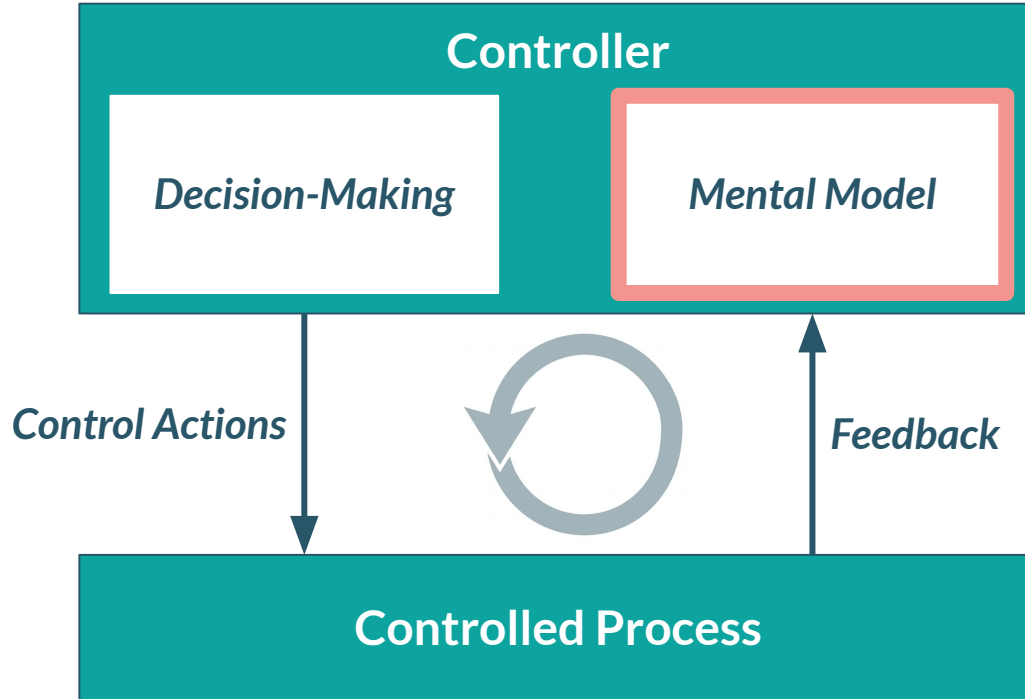
Control-Feedback Loop



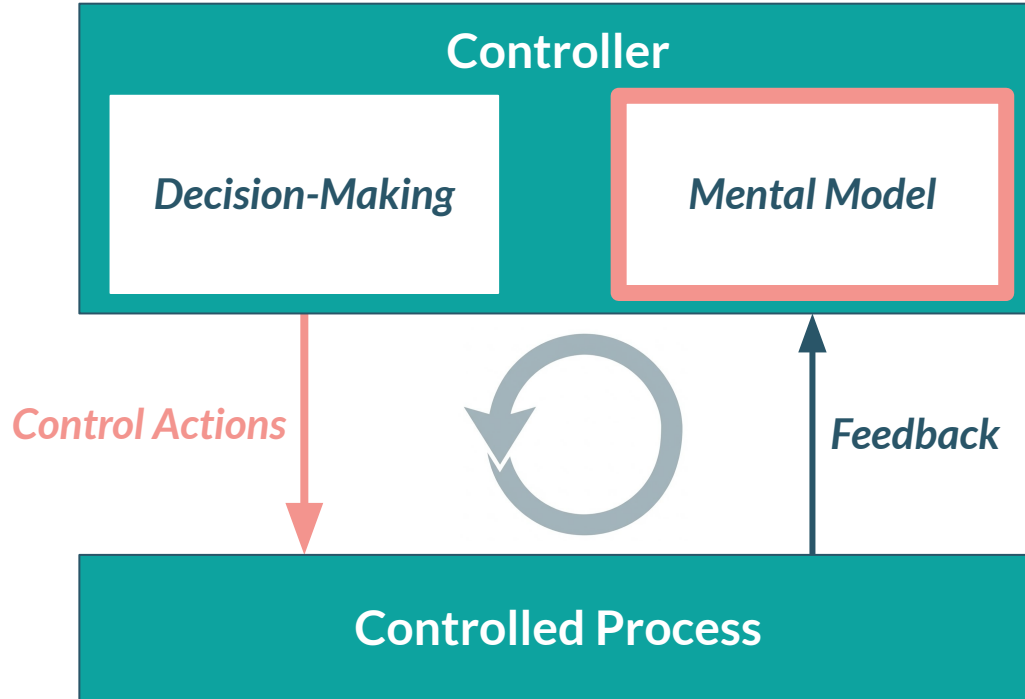
Adaptive Behavior



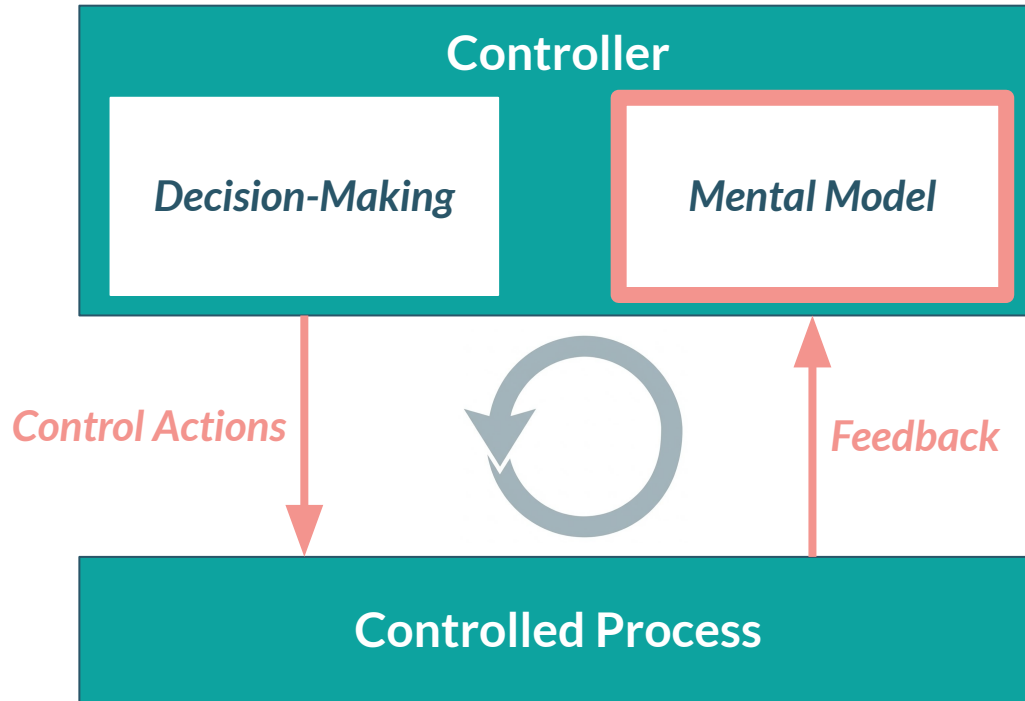
Unsafe Behavior



Unsafe Behavior

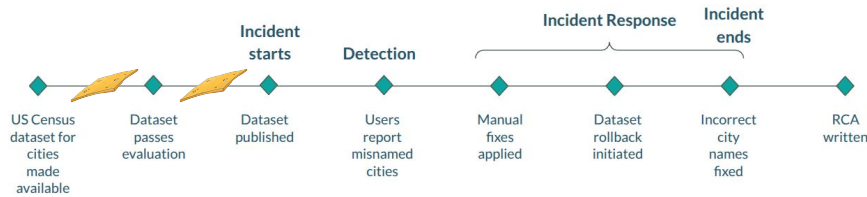


Unsafe Behavior

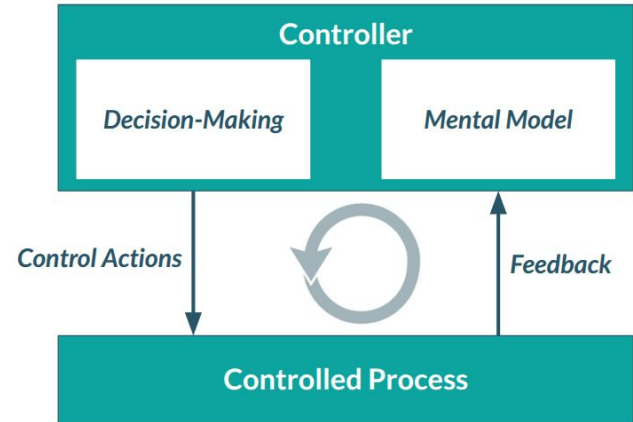


Accident Models: Different Focus

Preventing events

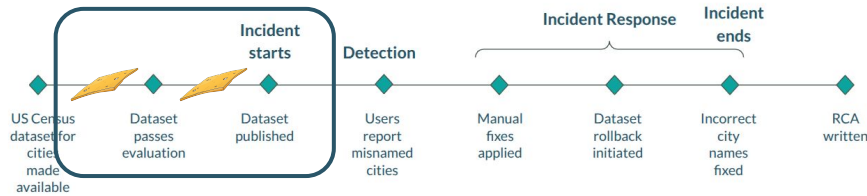


Constraining behavior

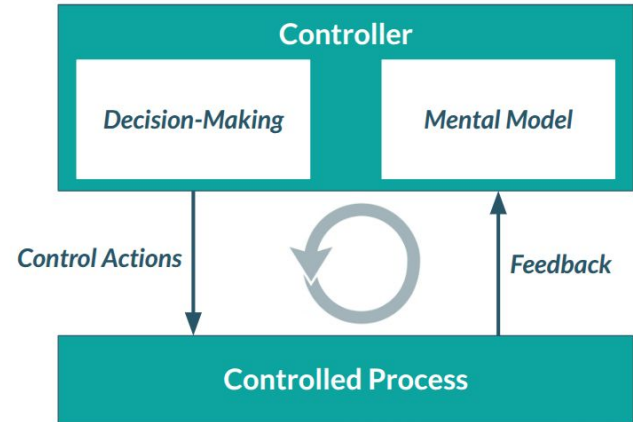


Accident Models: Different Focus

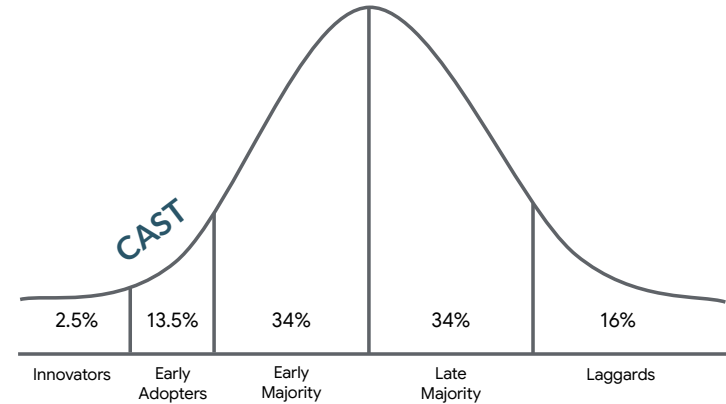
Preventing events



Constraining behavior



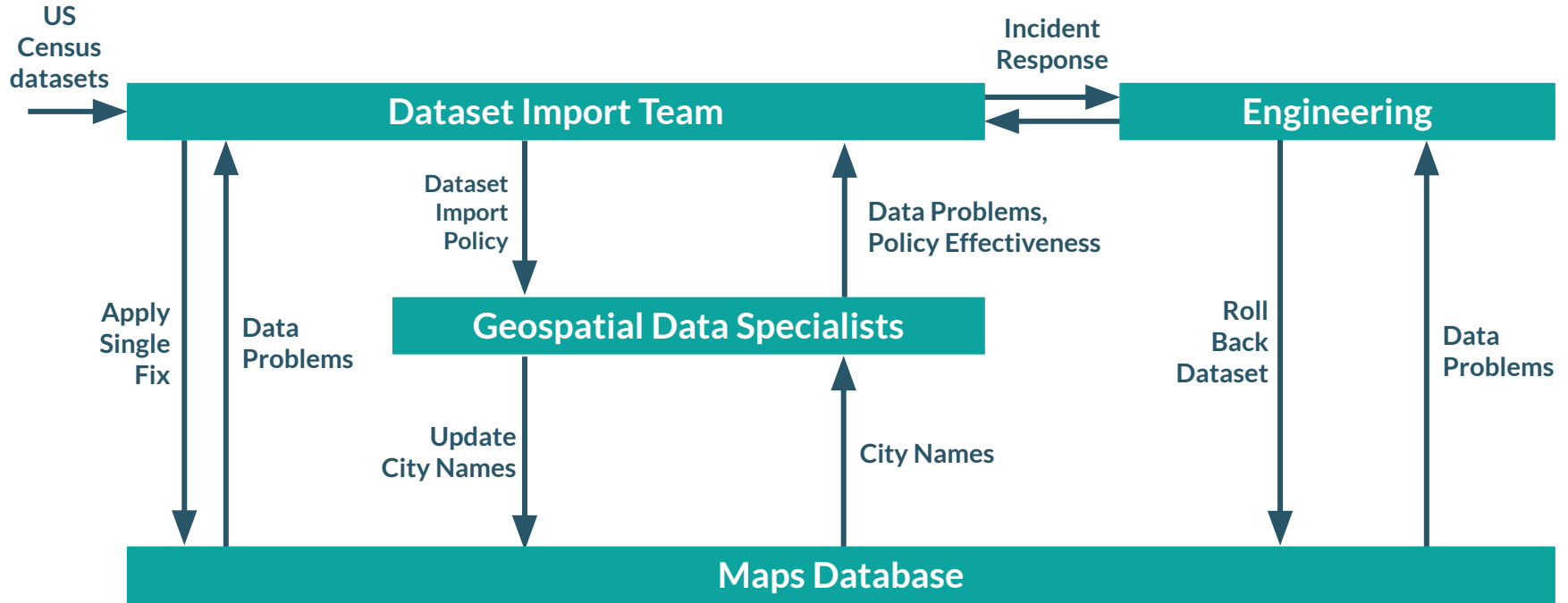
25+ years of RCA *and nothing else*



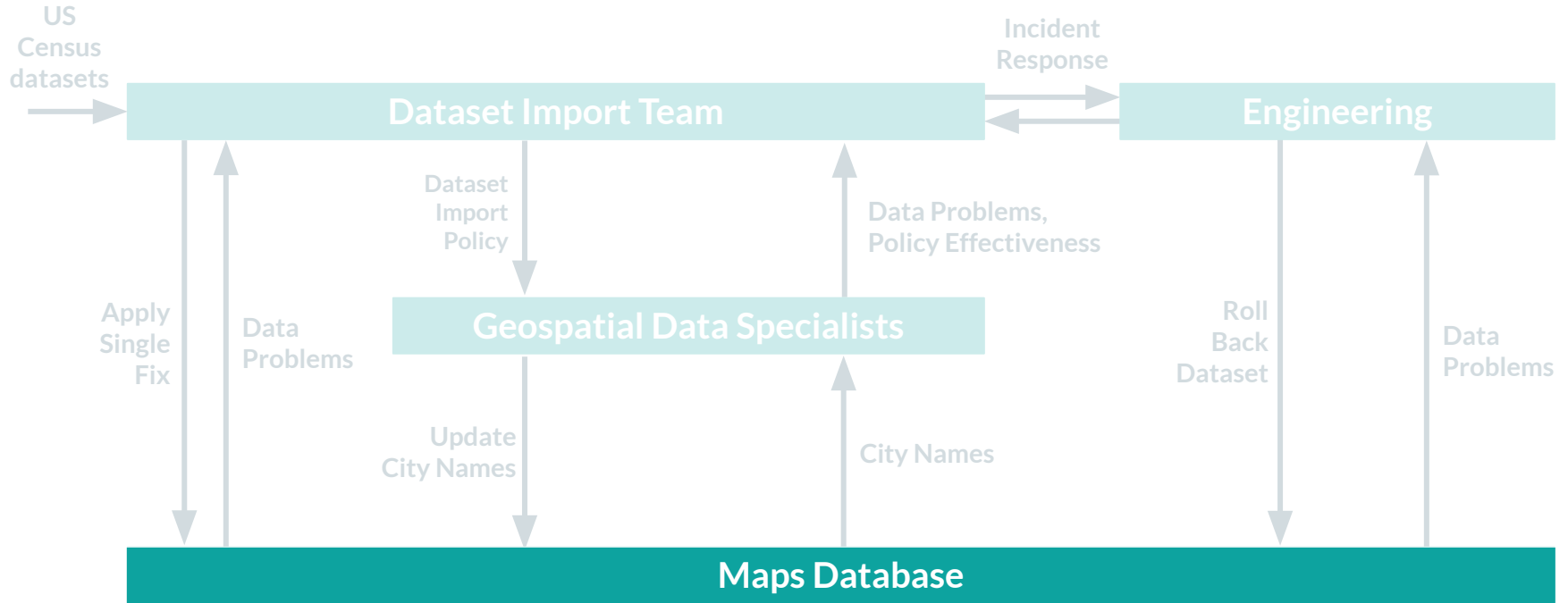
Rogers, E. M. & Shoemaker, F. F. (1971). *Communication of Innovation*. New York: The Free Press.

CAST

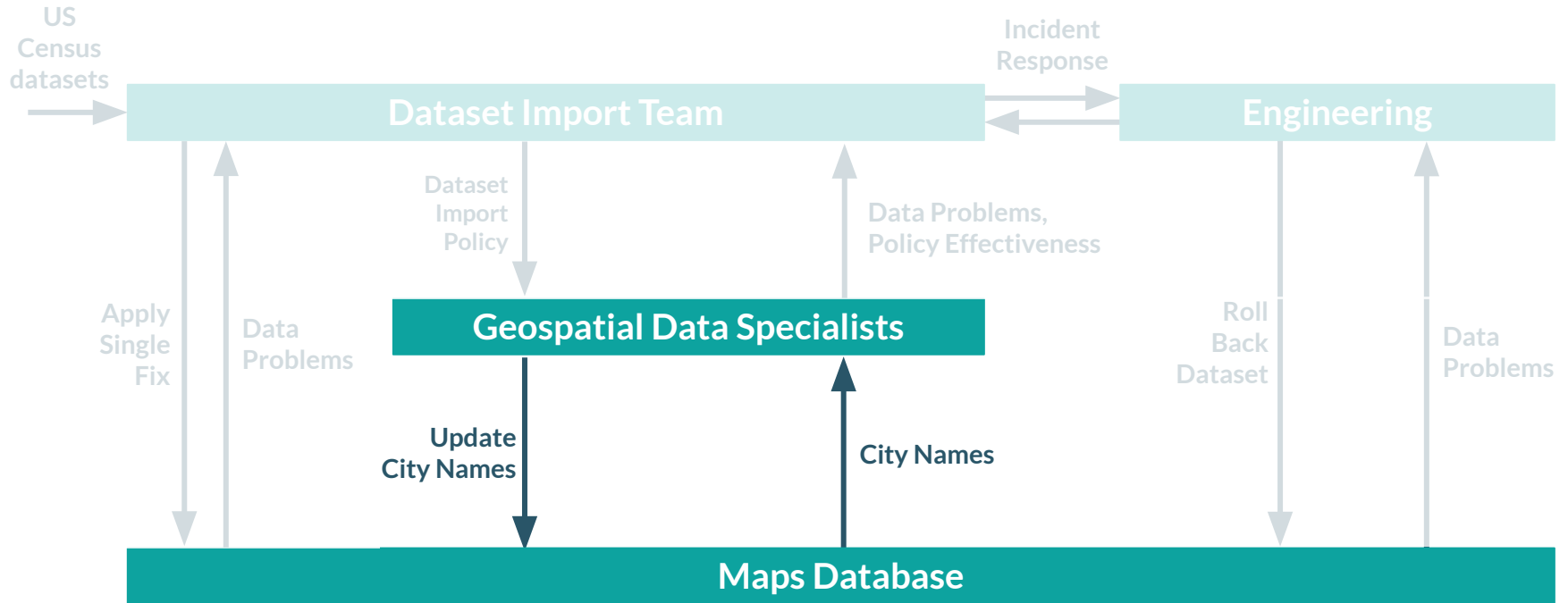
Control Structure



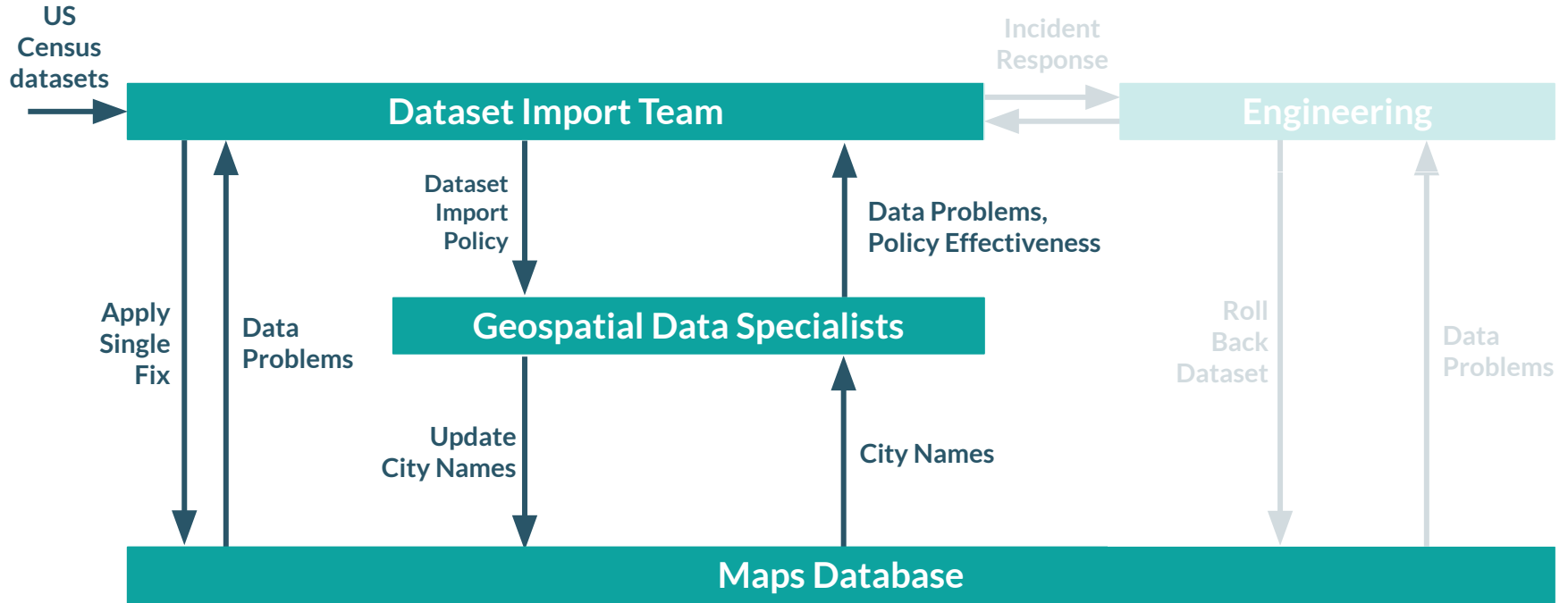
Control Structure



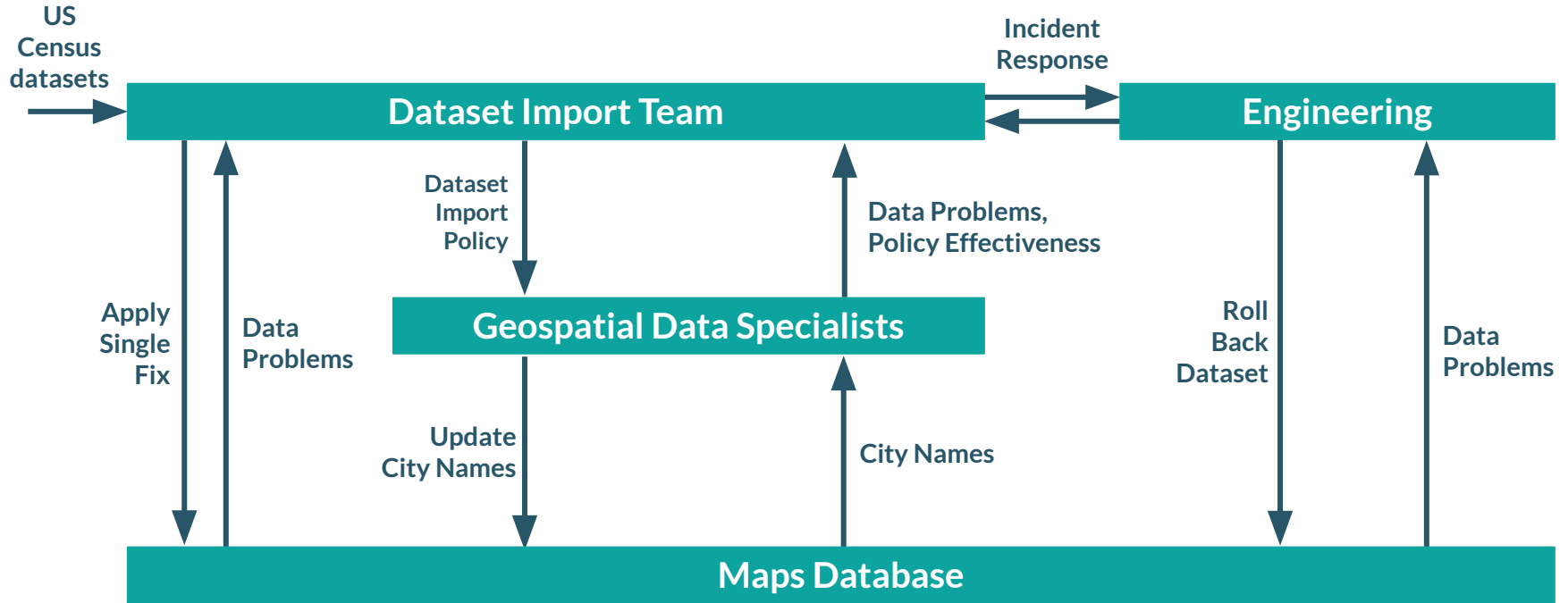
Control Structure



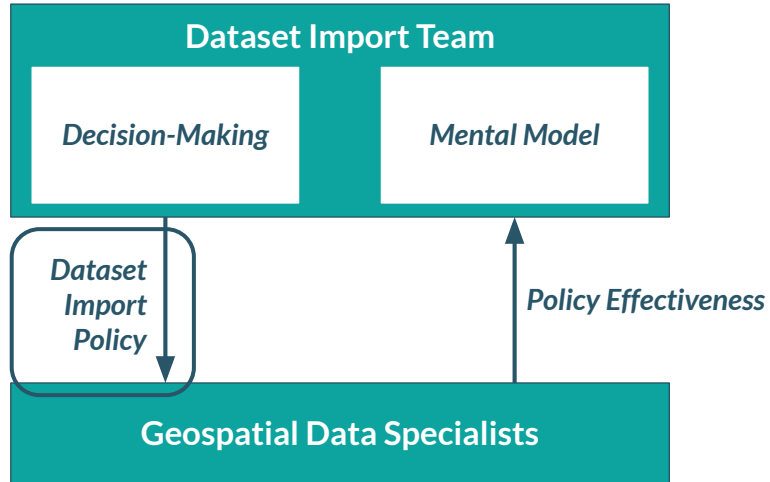
Control Structure



Control Structure

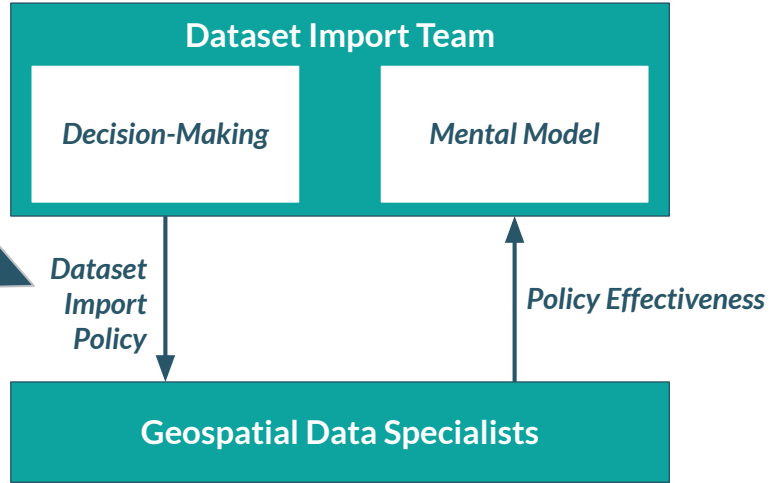


Controller: Dataset Import Team



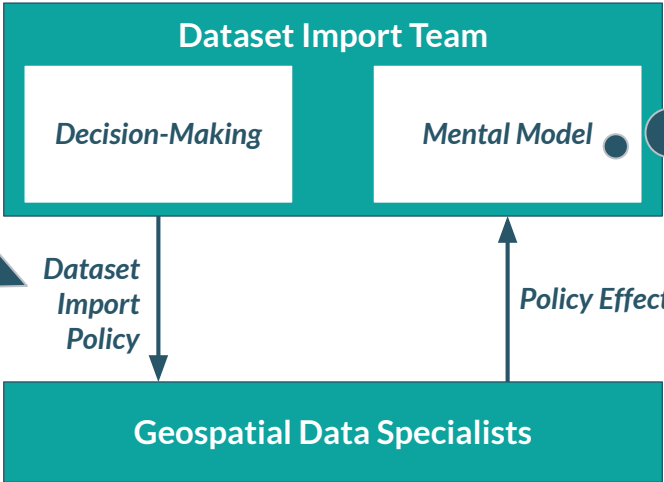
Dataset Import Team: Contribution to Incident

Didn't update the dataset import policy to detect localized problems in the US Census dataset.



Dataset Import Team: Mental Model

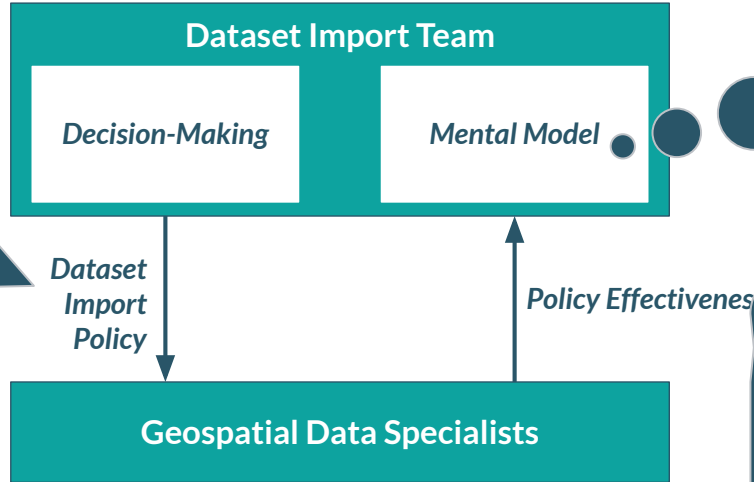
Didn't update the dataset import policy to detect localized problems in the US Census dataset.



Current import policy able to detect any problems in US Census dataset.

Dataset Import Team: Contextual Factors

Didn't update the dataset import policy to detect localized problems in the US Census dataset.

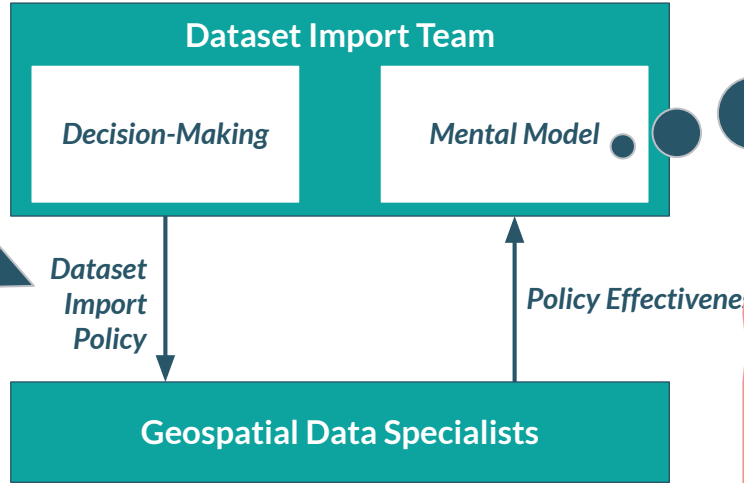


Current import policy able to detect all problems in US Census dataset.

- Previous datasets uniformly distributed
- First time importing US Census Dataset with city information

Dataset Import Team: Contextual Factors

Didn't update the dataset import policy to detect localized problems in the US Census dataset.

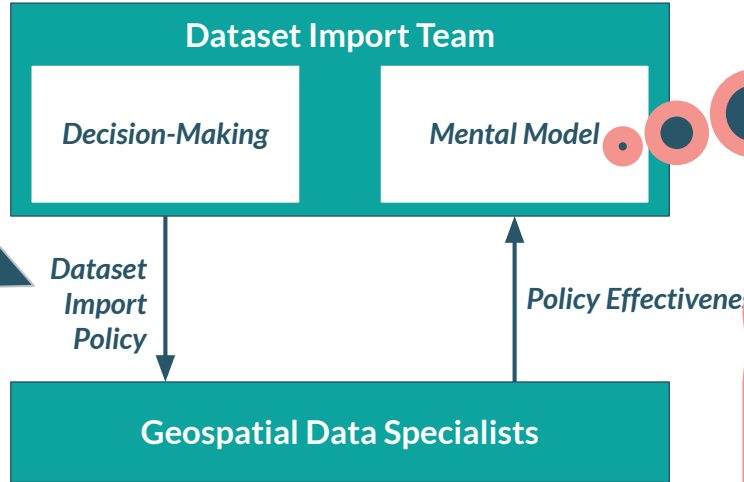


Current import policy able to detect all problems in US Census dataset.

- Previous datasets uniformly distributed
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Dataset Import Team: Mental Model

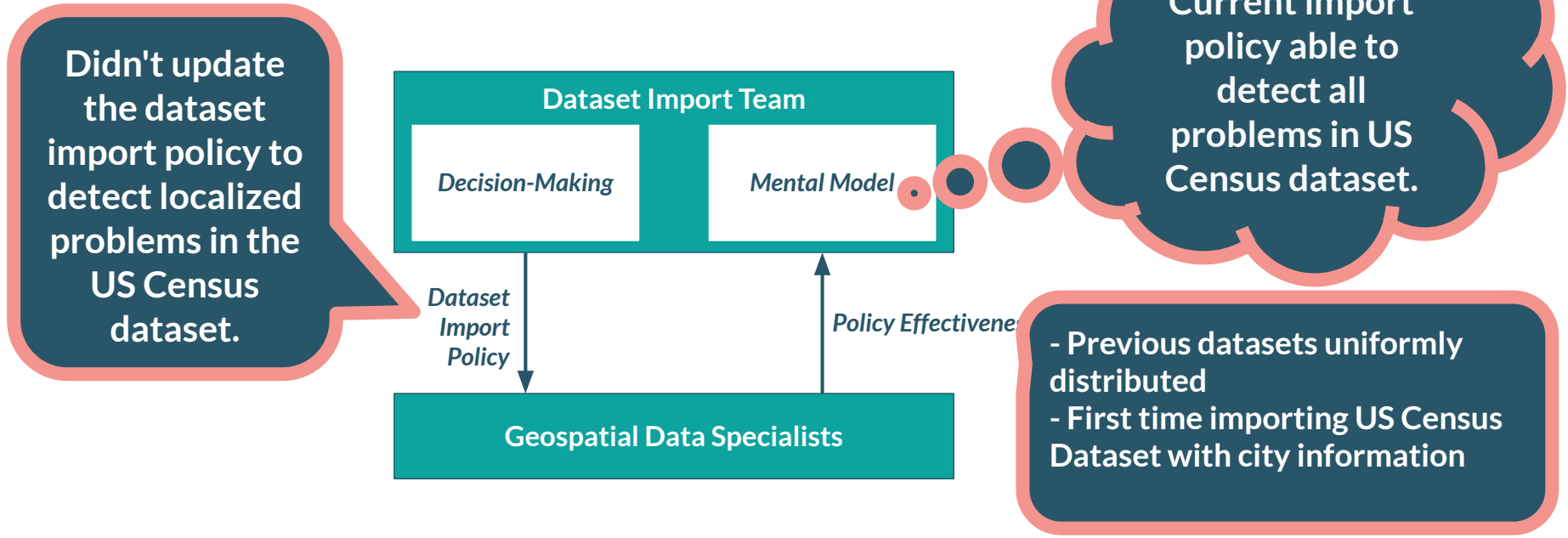
Didn't update the dataset import policy to detect localized problems in the US Census dataset.



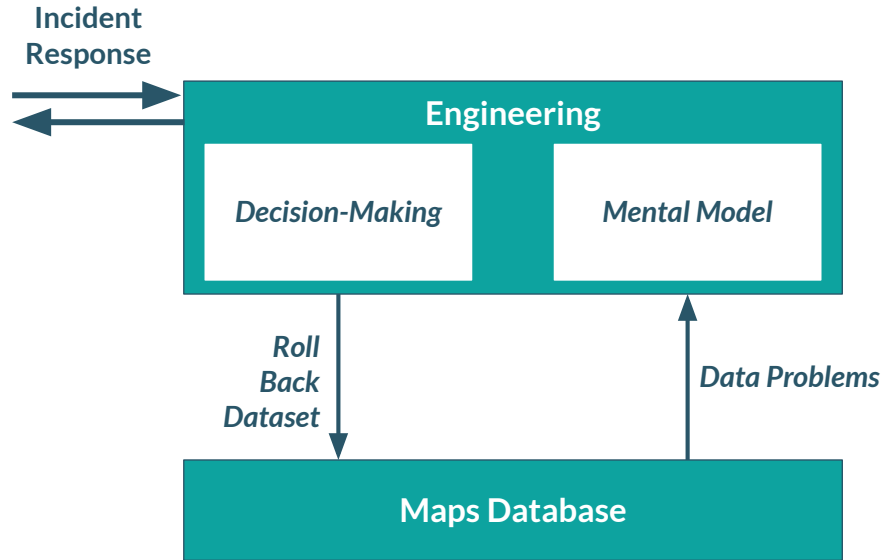
Current import policy able to detect all problems in US Census dataset.

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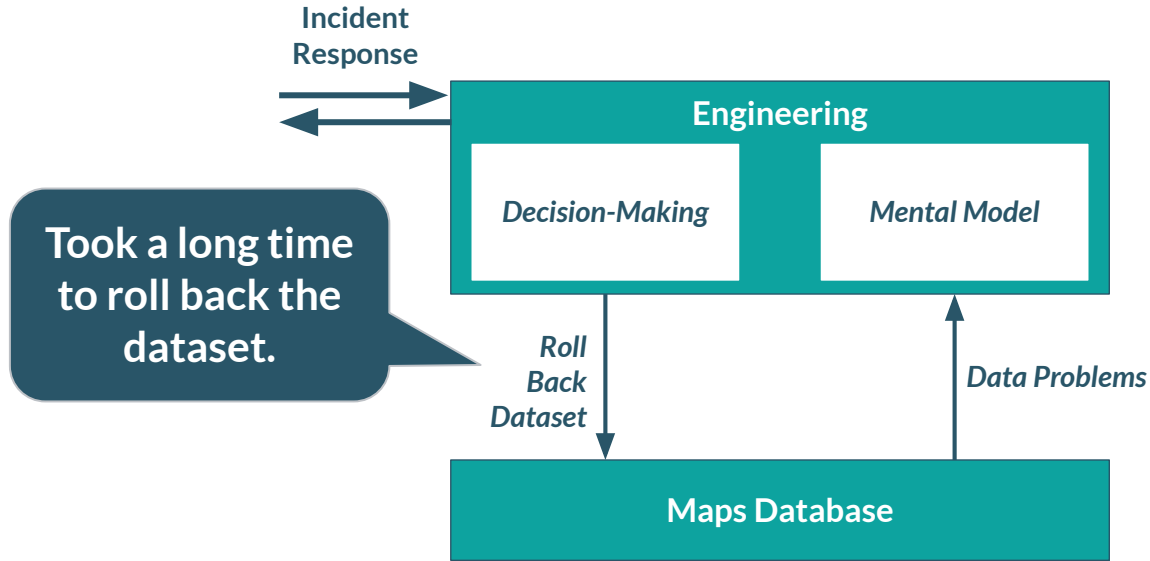
Dataset Import Team: Contribution to Incident



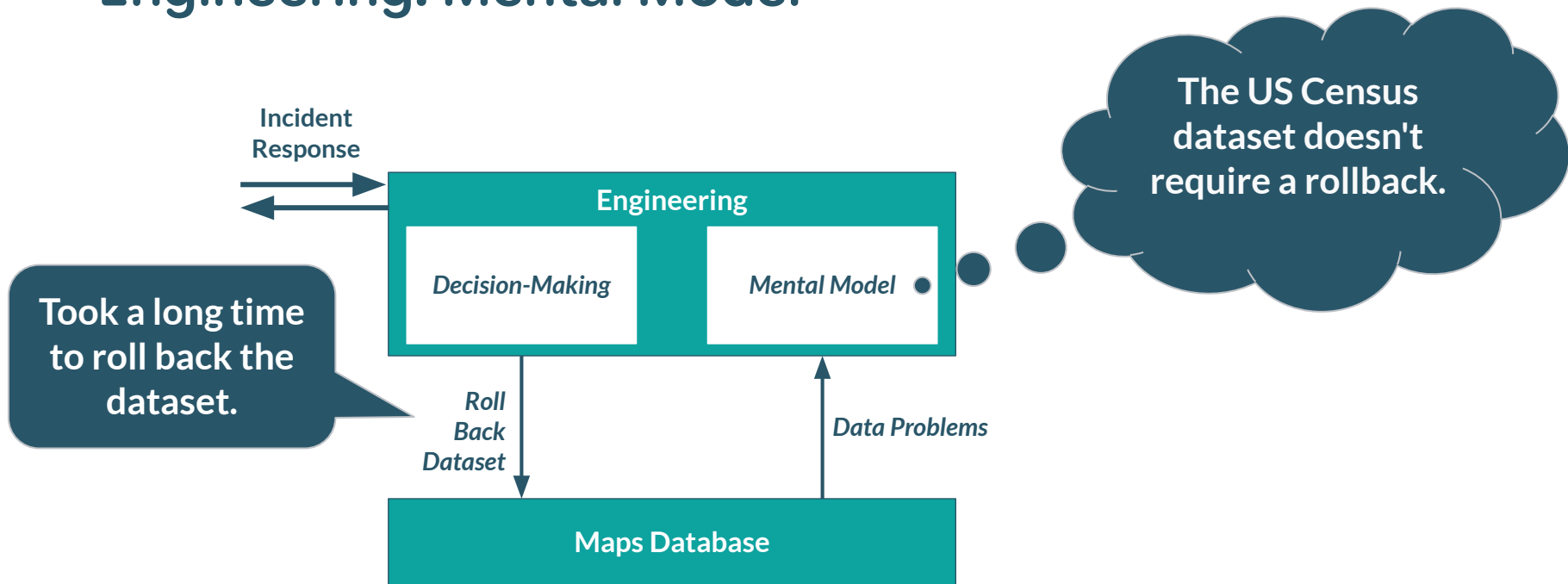
Controller: Engineering



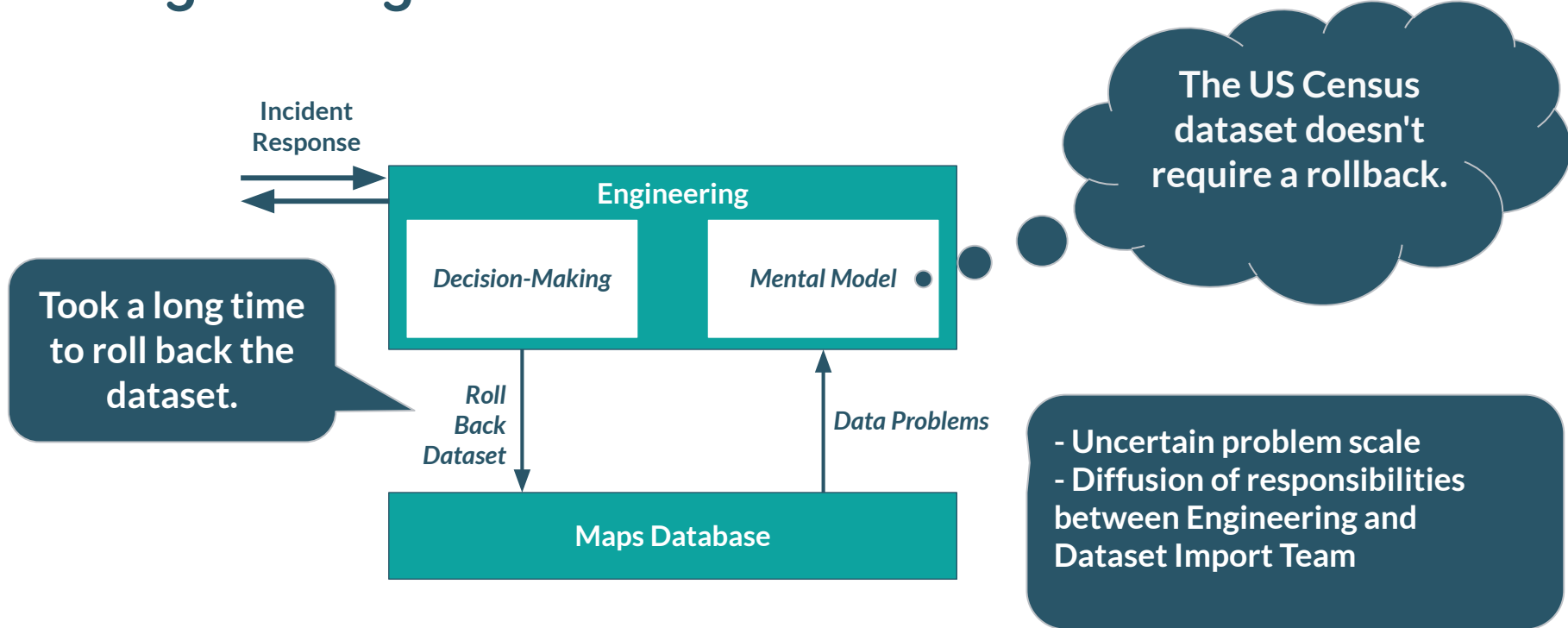
Engineering: Contribution to Incident



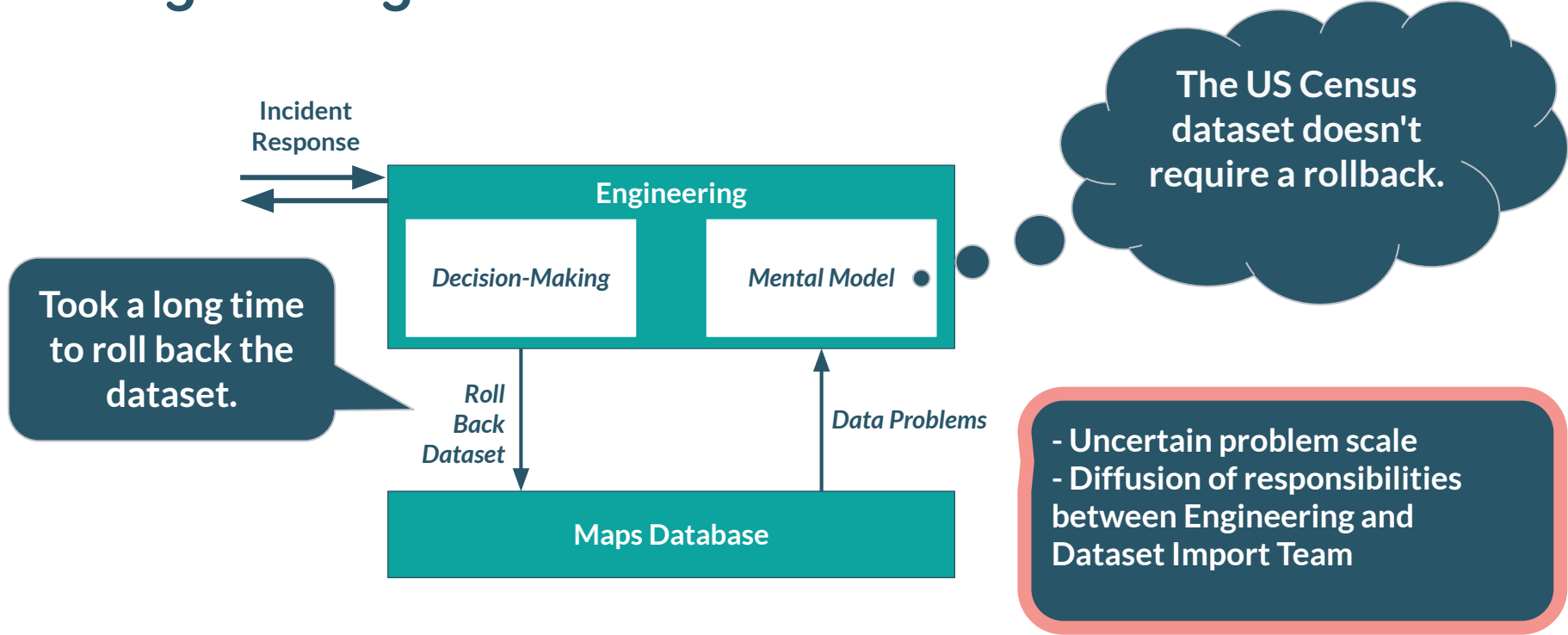
Engineering: Mental Model



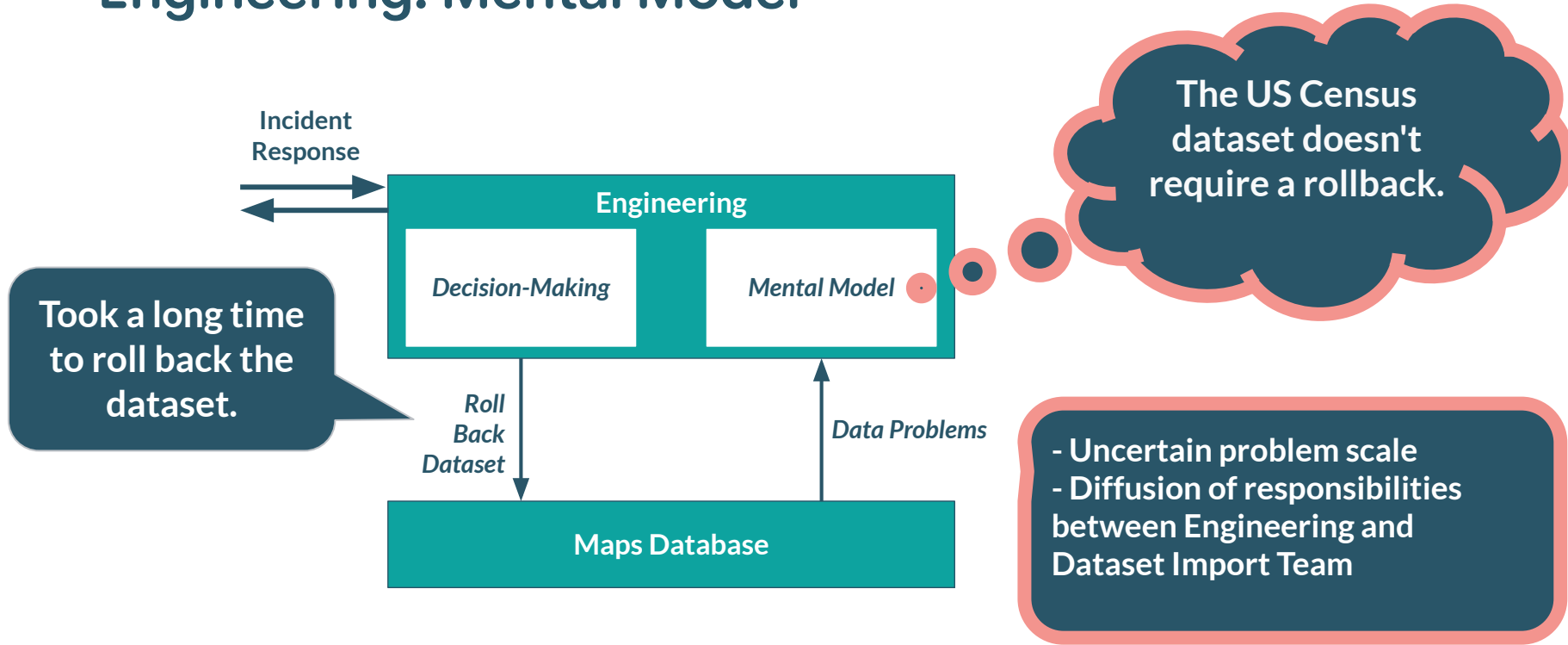
Engineering: Contextual Factors



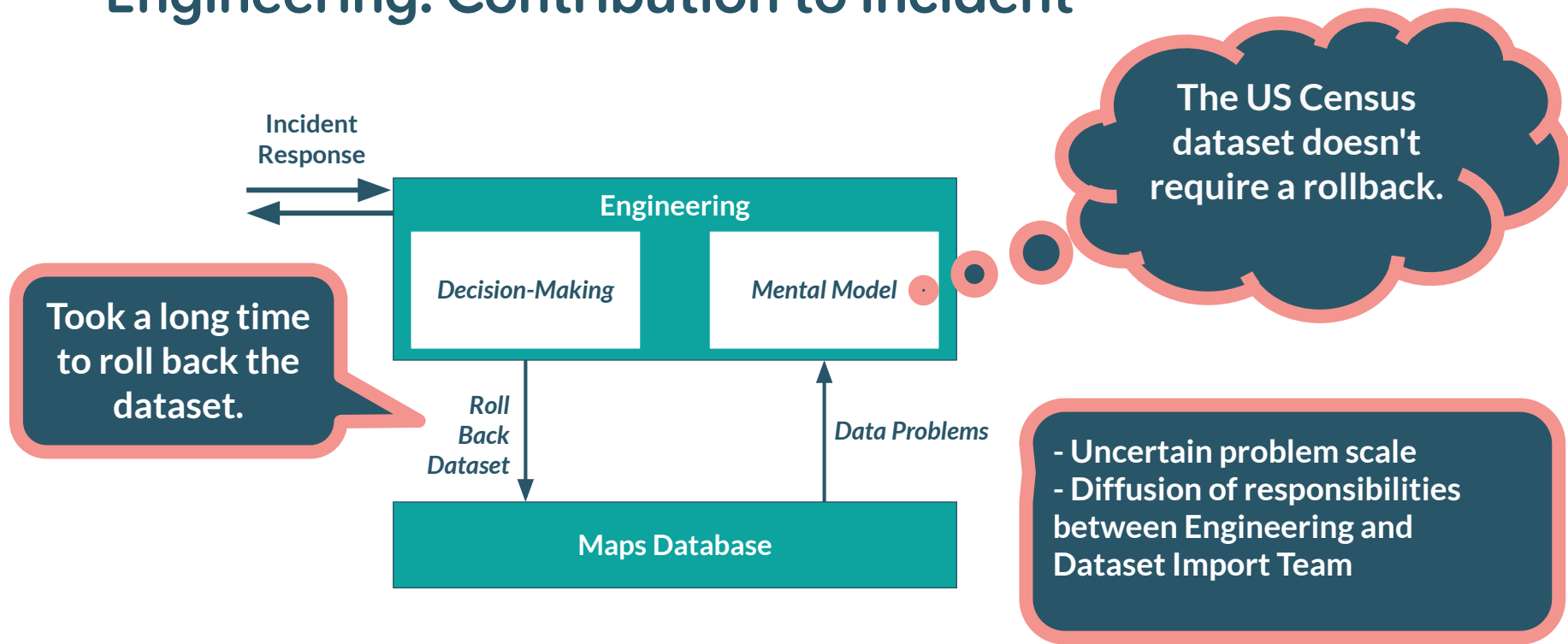
Engineering: Contextual Factors



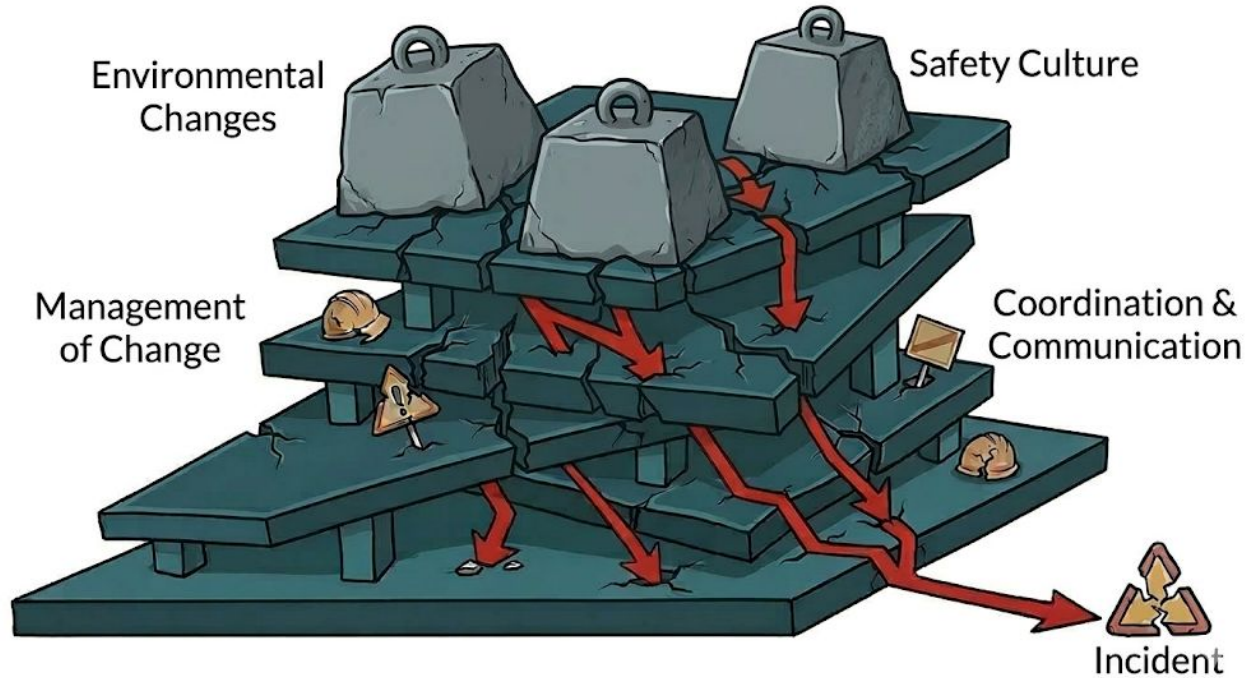
Engineering: Mental Model



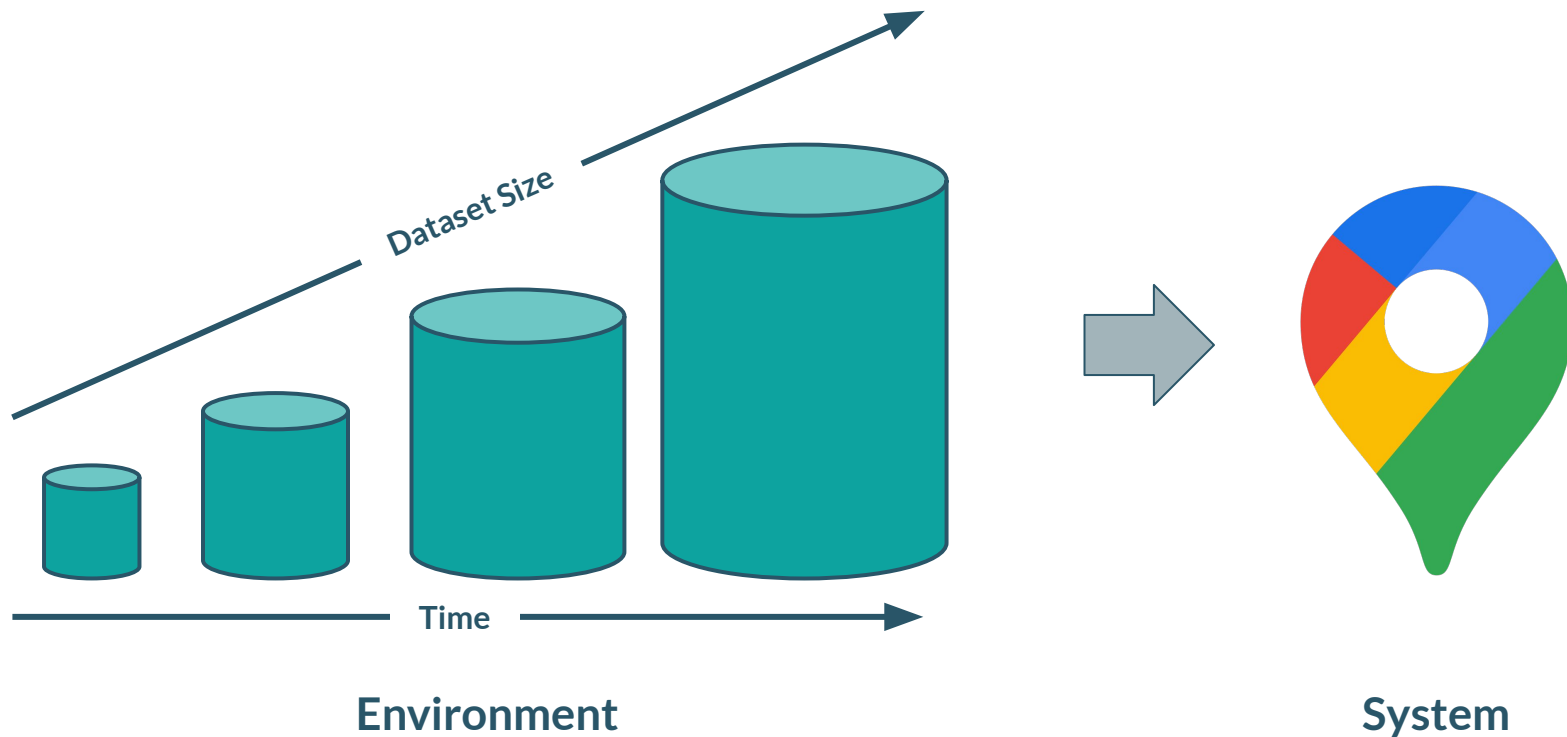
Engineering: Contribution to Incident



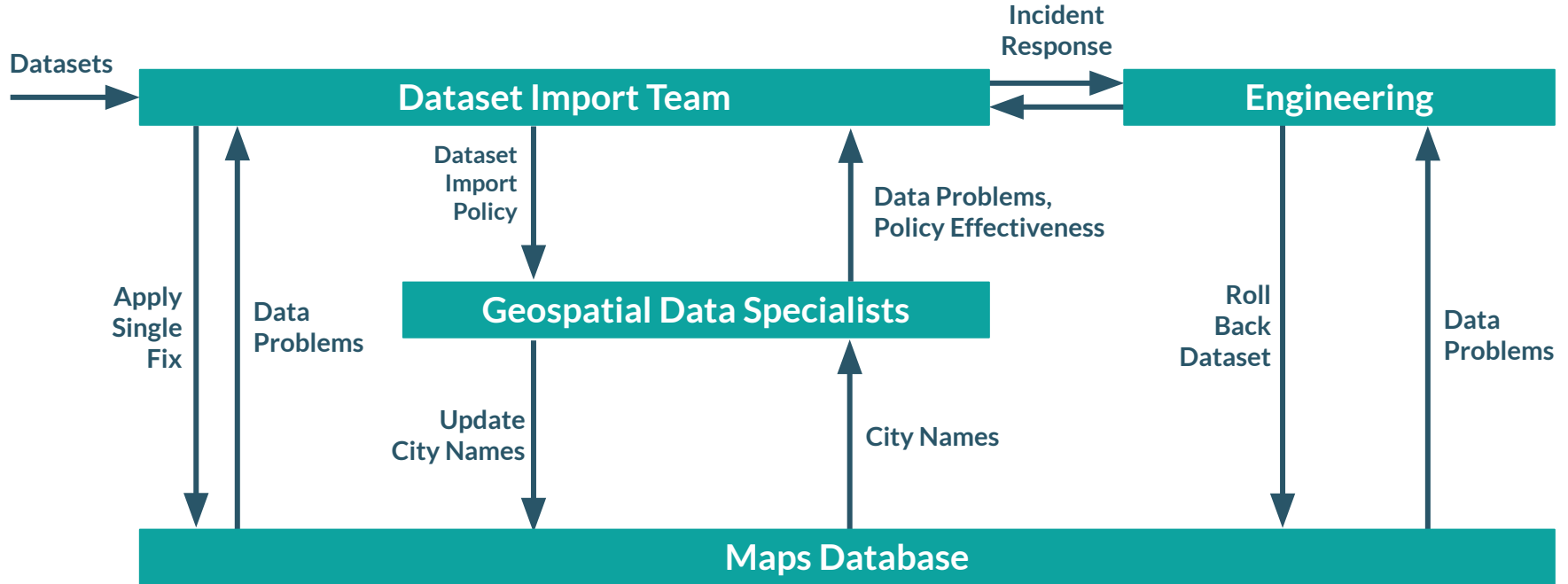
Systemic Factors



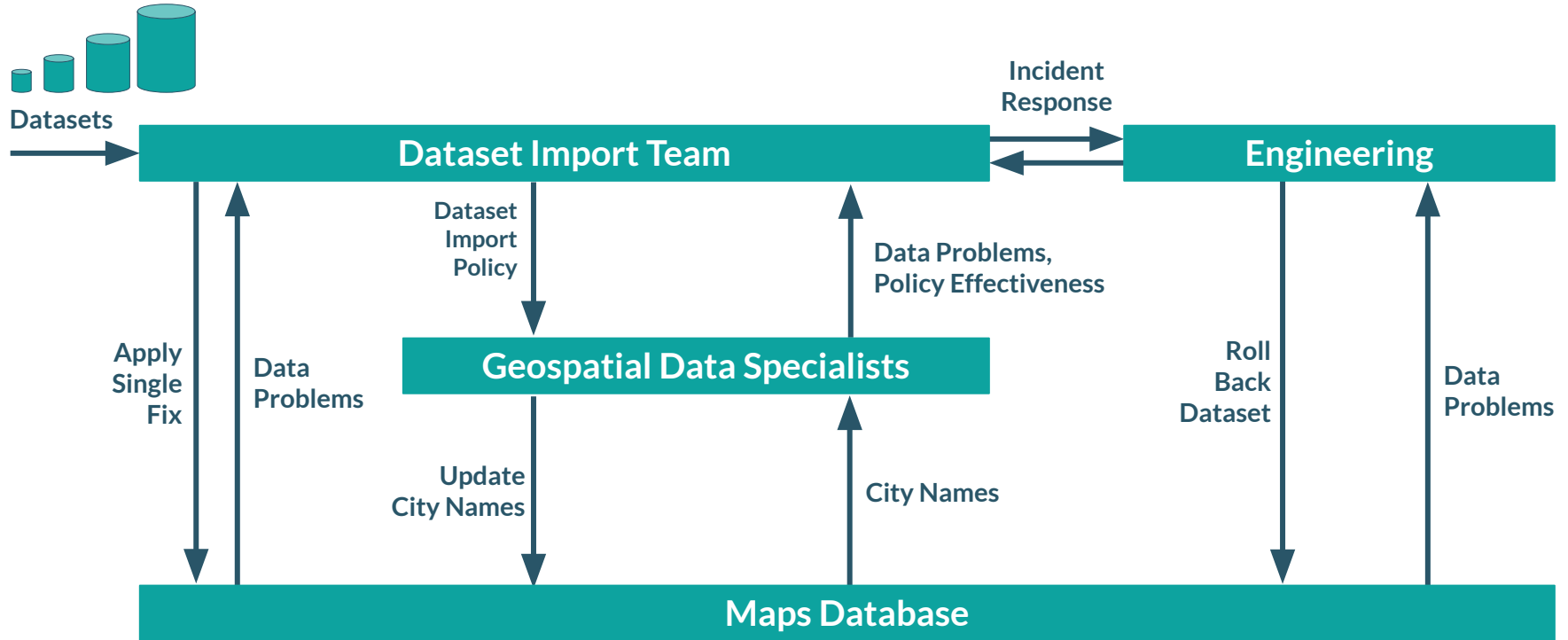
Systemic Factor: Dynamic Environment



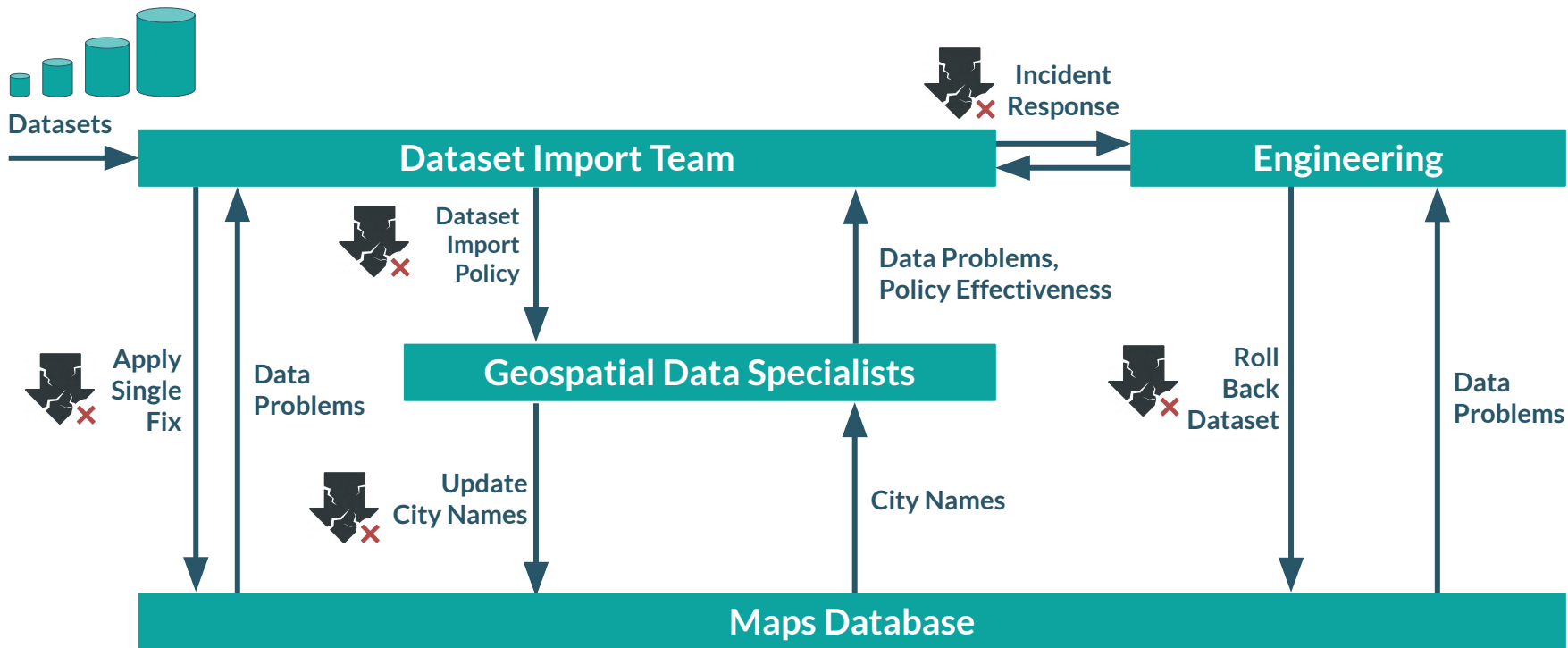
Systemic Factor: Dynamic Environment



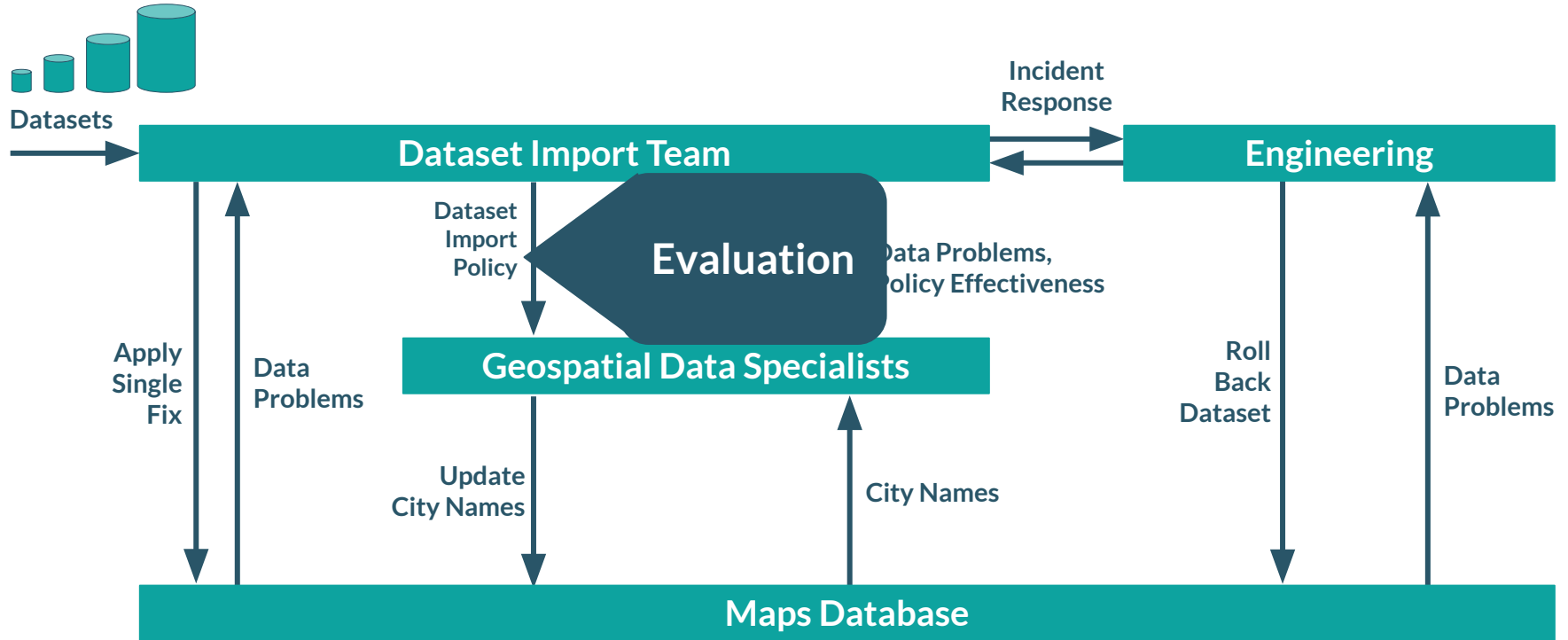
Systemic Factor: Dynamic Environment



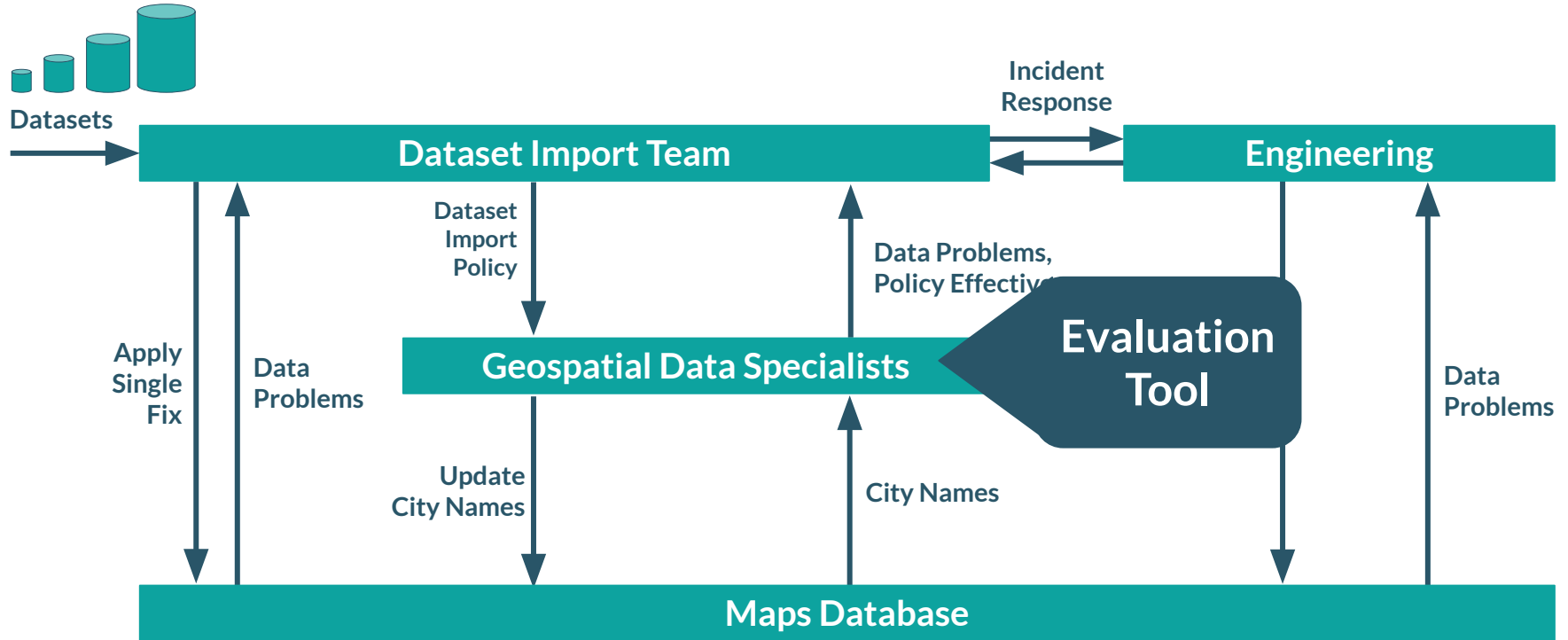
Systemic Factor: Dynamic Environment



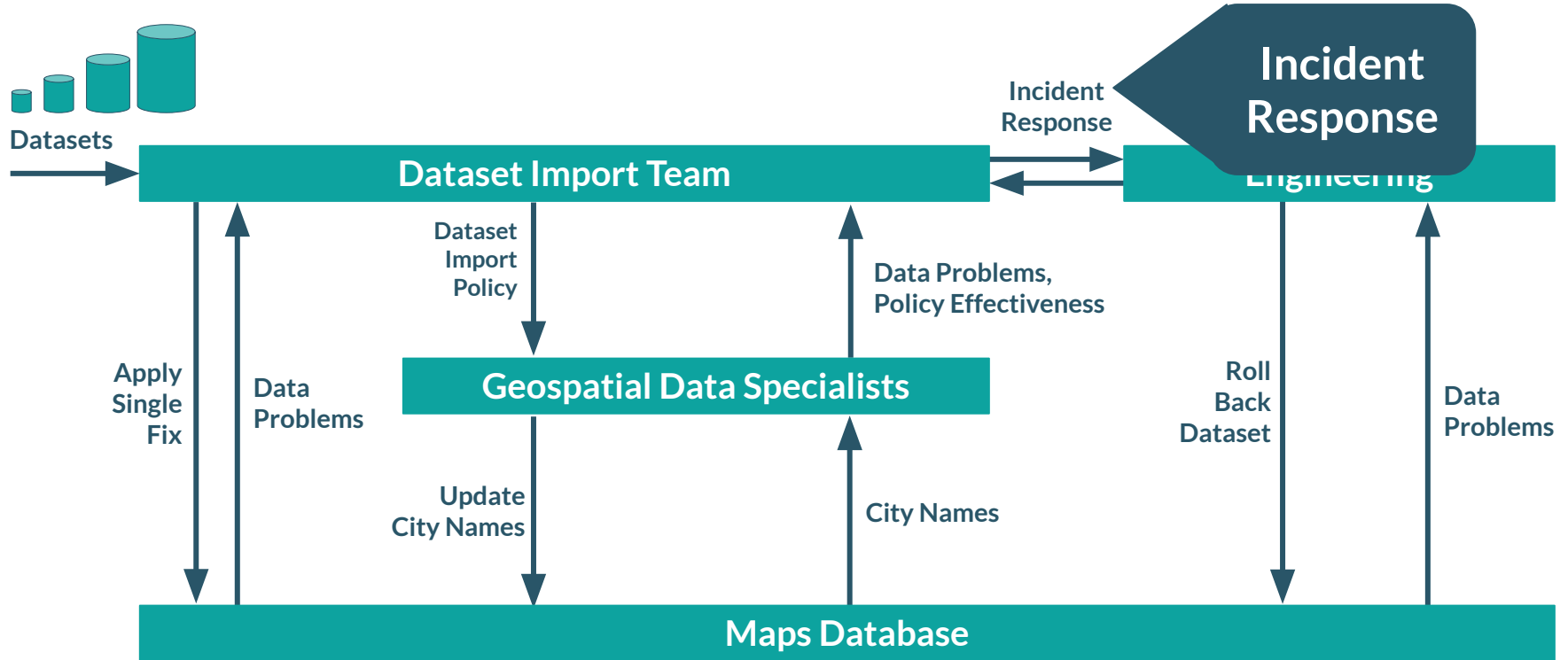
Weakened Controls: Evaluation



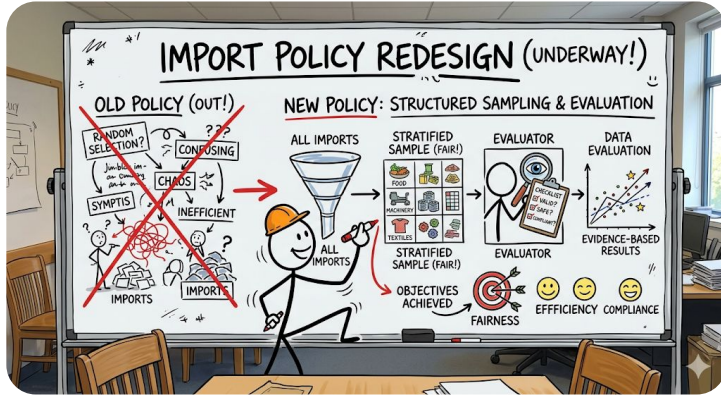
Weakened Controls: Evaluation Tool



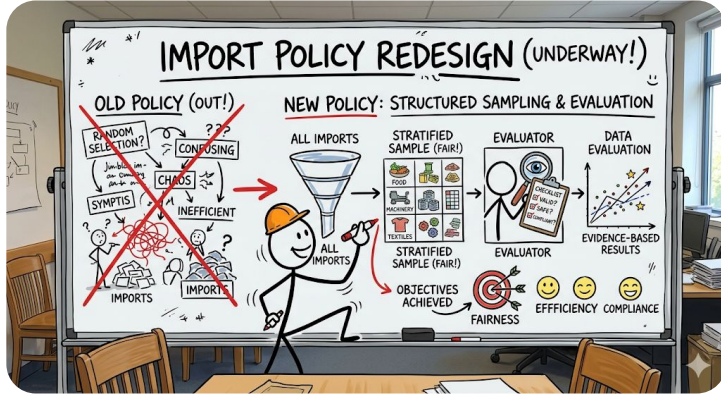
Weakened Controls: Incident Response



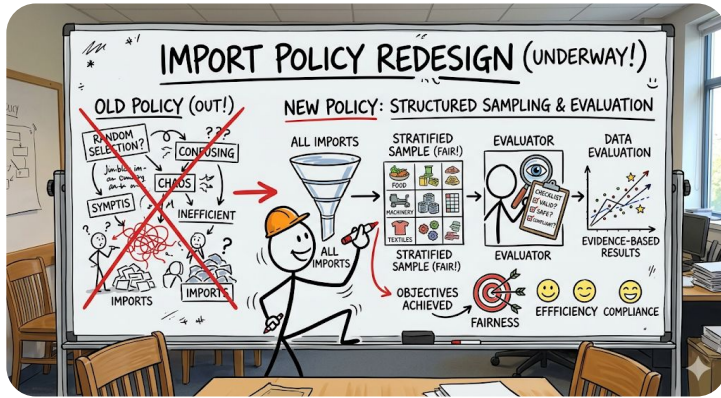
CAST: Improvement Plan



CAST: Improvement Plan

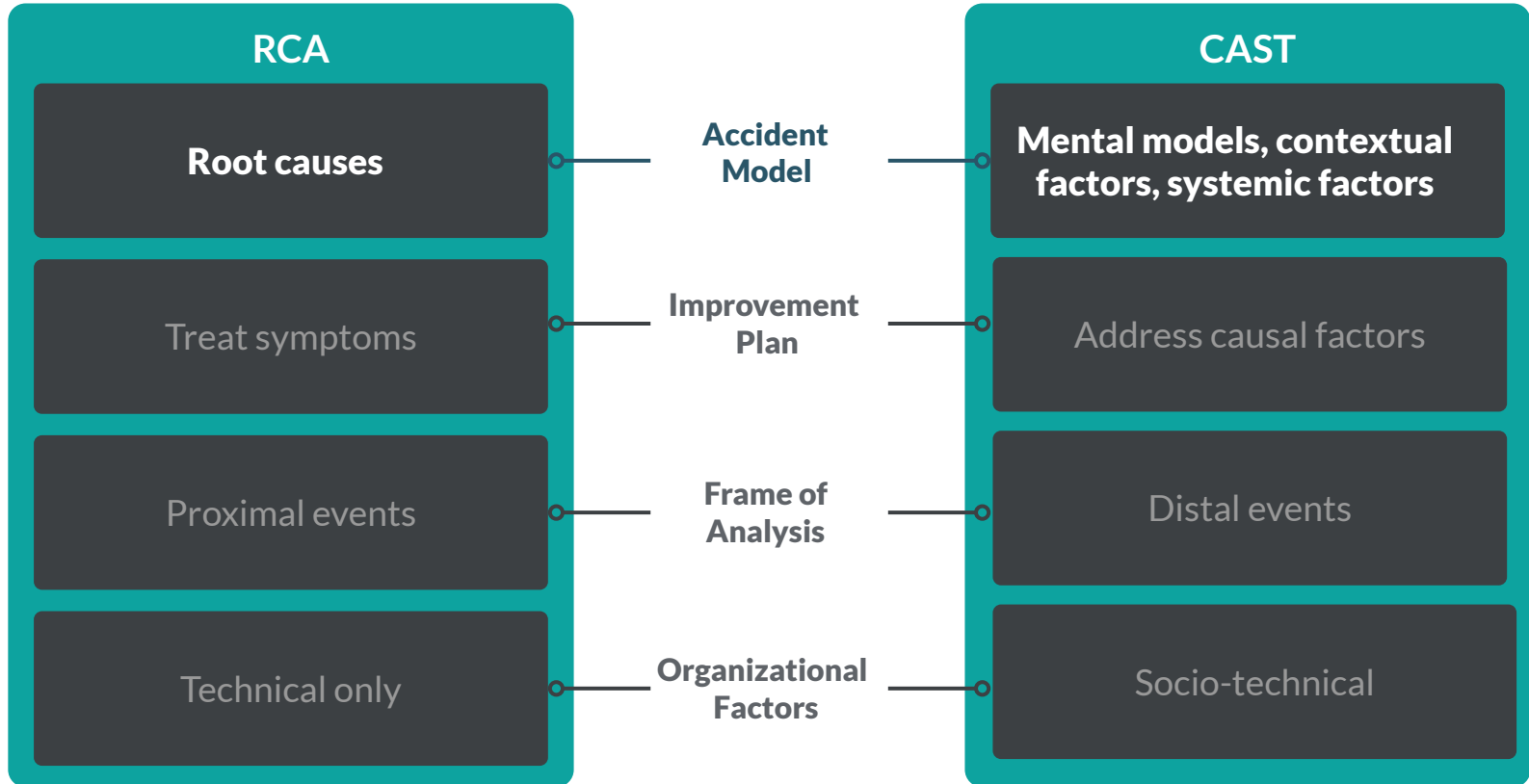


CAST: Improvement Plan

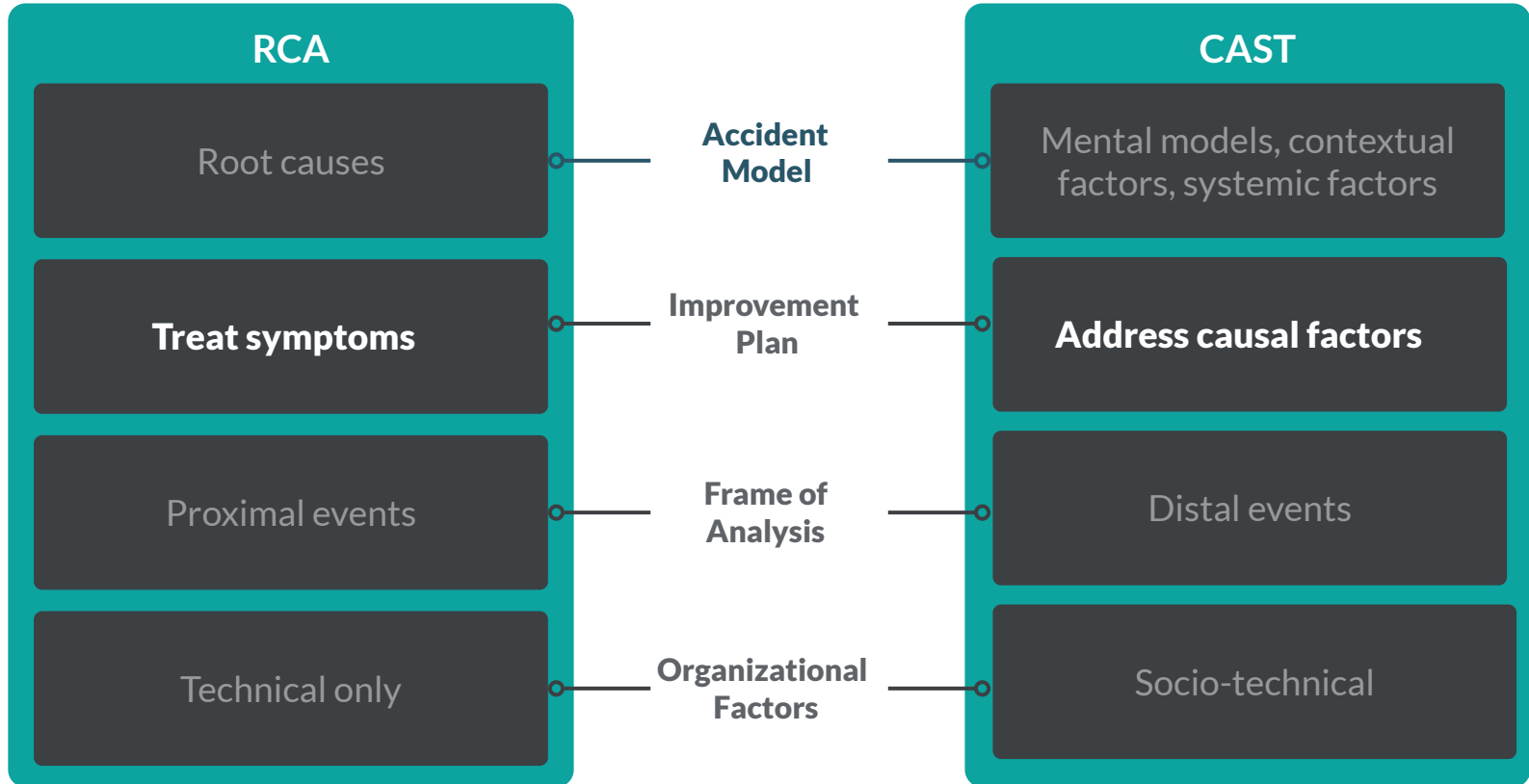


RCA vs CAST

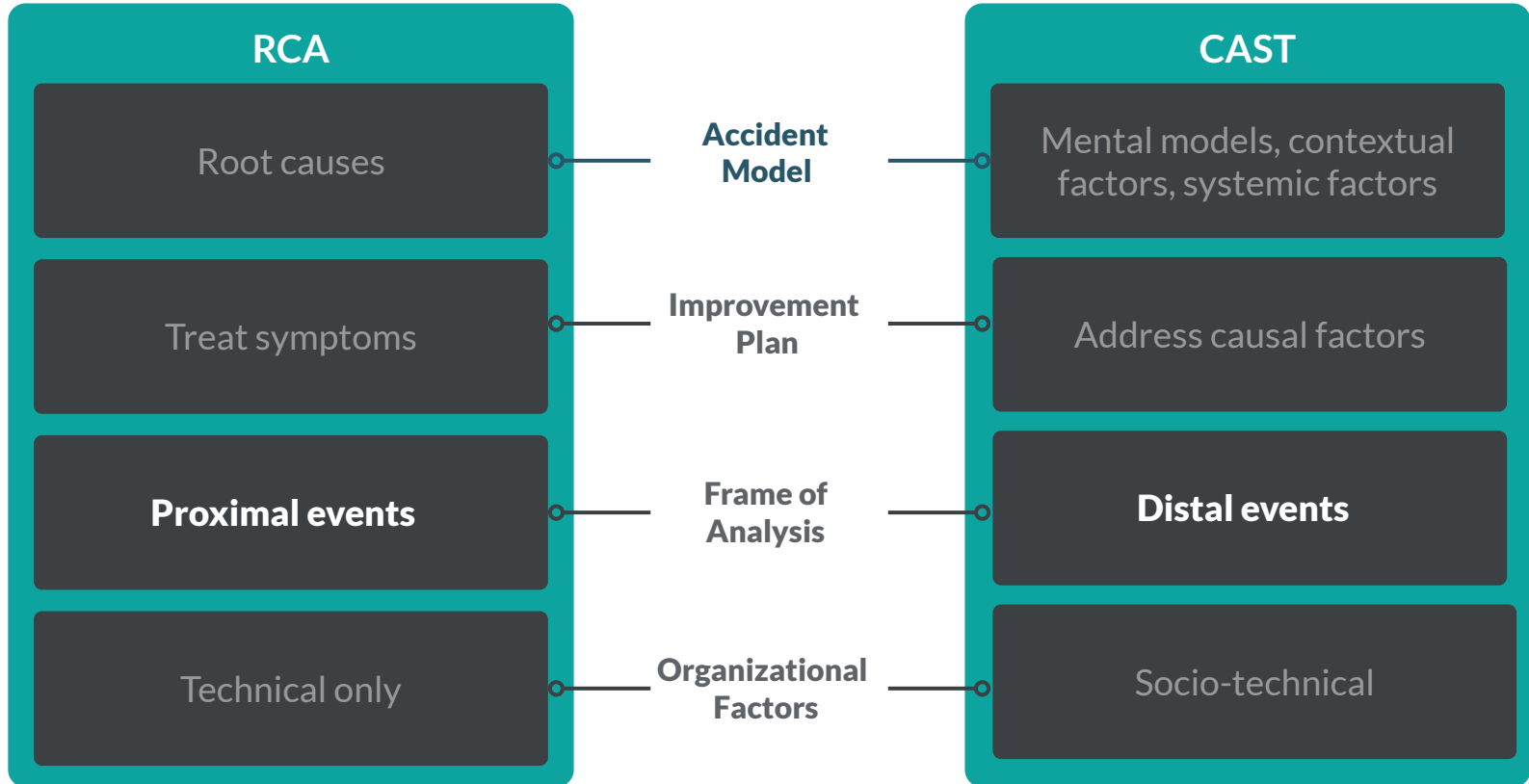
RCA vs CAST



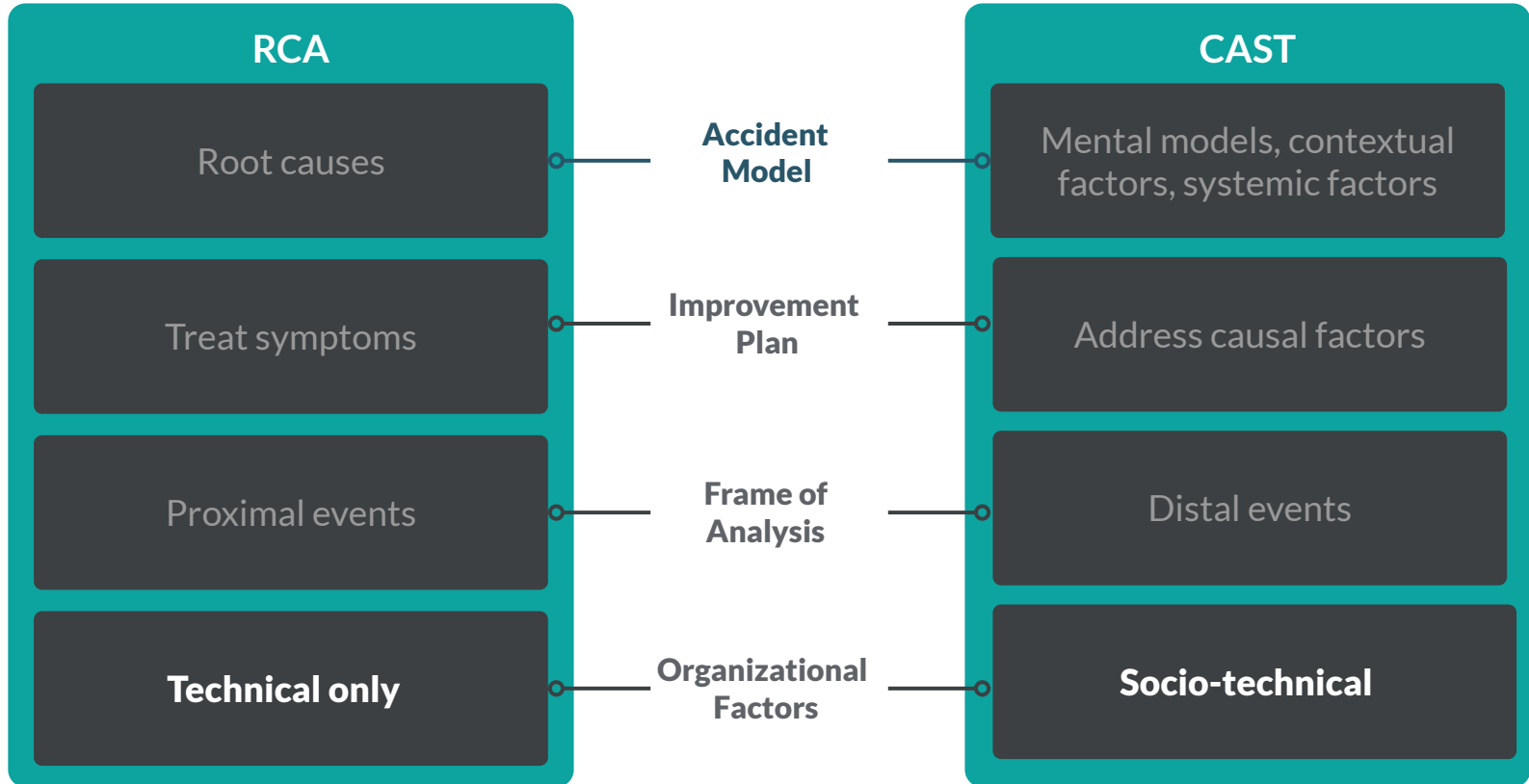
RCA vs CAST



RCA vs CAST



RCA vs CAST



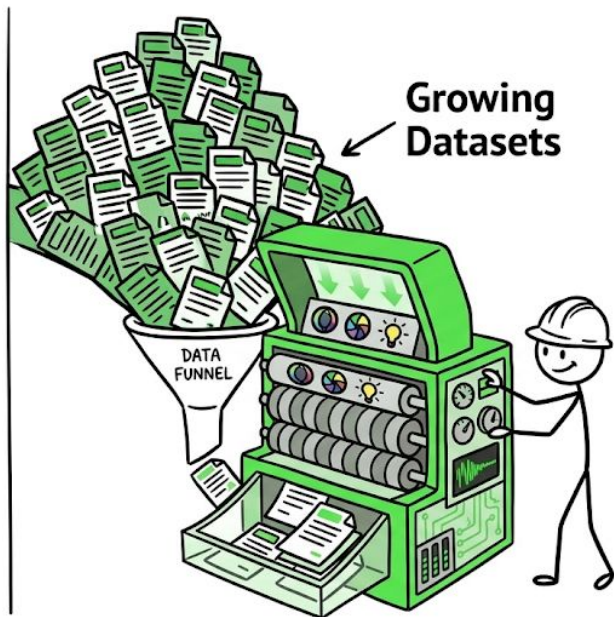
Takeaways

Takeaways

RCA

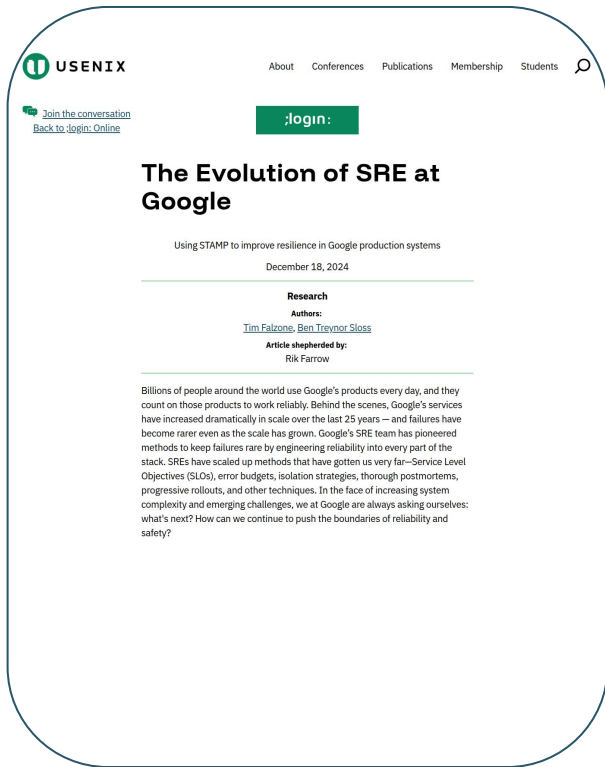


CAST




Resources

Resources



The screenshot shows the top of a USENIX article page. At the top left is the USENIX logo. To its right are navigation links: About, Conferences, Publications, Membership, Students, and a search icon. Below the navigation is a green button with the text ':login:'. Underneath the button are two links: 'Join the conversation' and 'Back to :login: Online'. The main title of the article is 'The Evolution of SRE at Google'. Below the title is the subtitle 'Using STAMP to improve resilience in Google production systems' and the date 'December 18, 2024'. Further down, it lists 'Research' and 'Authors: Tim Falkone, Ben Trevnor Sloss'. Below that, it says 'Article shepherded by: Rik Farrow'. The main body of text begins with 'Billions of people around the world use Google's products every day, and they count on those products to work reliably. Behind the scenes, Google's services have increased dramatically in scale over the last 25 years – and failures have become rarer even as the scale has grown. Google's SRE team has pioneered methods to keep failures rare by engineering reliability into every part of the stack. SREs have scaled up methods that have gotten us very far—Service Level Objectives (SLOs), error budgets, isolation strategies, thorough postmortems, progressive rollouts, and other techniques. In the face of increasing system complexity and emerging challenges, we at Google are always asking ourselves: what's next? How can we continue to push the boundaries of reliability and safety?'

https://is.gd/google_sre_evolution

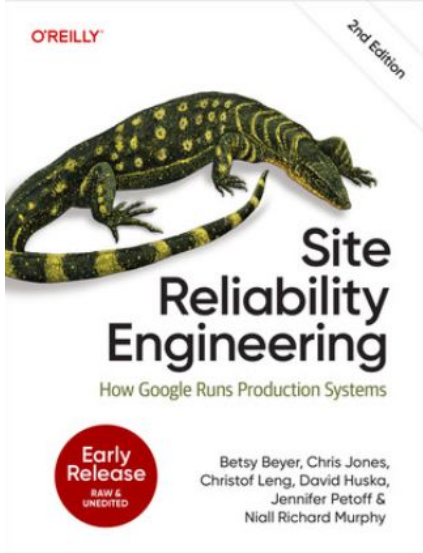


The image shows a dramatic scene of a large fire or explosion at night, with bright orange and yellow flames rising from a dark sea or land. The sky is dark and filled with thick, dark smoke. The overall atmosphere is one of intense heat and destruction.

CAST HANDBOOK: How to Learn More from Incidents and Accidents

Nancy G. Leveson

https://is.gd/CAST_handbook



The image shows the cover of the book 'Site Reliability Engineering: How Google Runs Production Systems' by Betsy Beyer, Chris Jones, Christof Leng, David Huska, Jennifer Petoff, and Niall Richard Murphy. The cover features a large, detailed illustration of a green and yellow spotted lizard. The title 'Site Reliability Engineering' is prominently displayed in a large, bold font. Below the title is the subtitle 'How Google Runs Production Systems'. The authors' names are listed at the bottom right. The O'Reilly logo is in the top left corner. A red circular badge in the bottom left corner says 'Early Release RAW & UNEDITED'. A white diagonal banner in the top right corner says '2nd Edition'.

CAST in upcoming chapter: *Safety Engineering for Software*

<https://is.gd/srebook2ed>

Thanks
