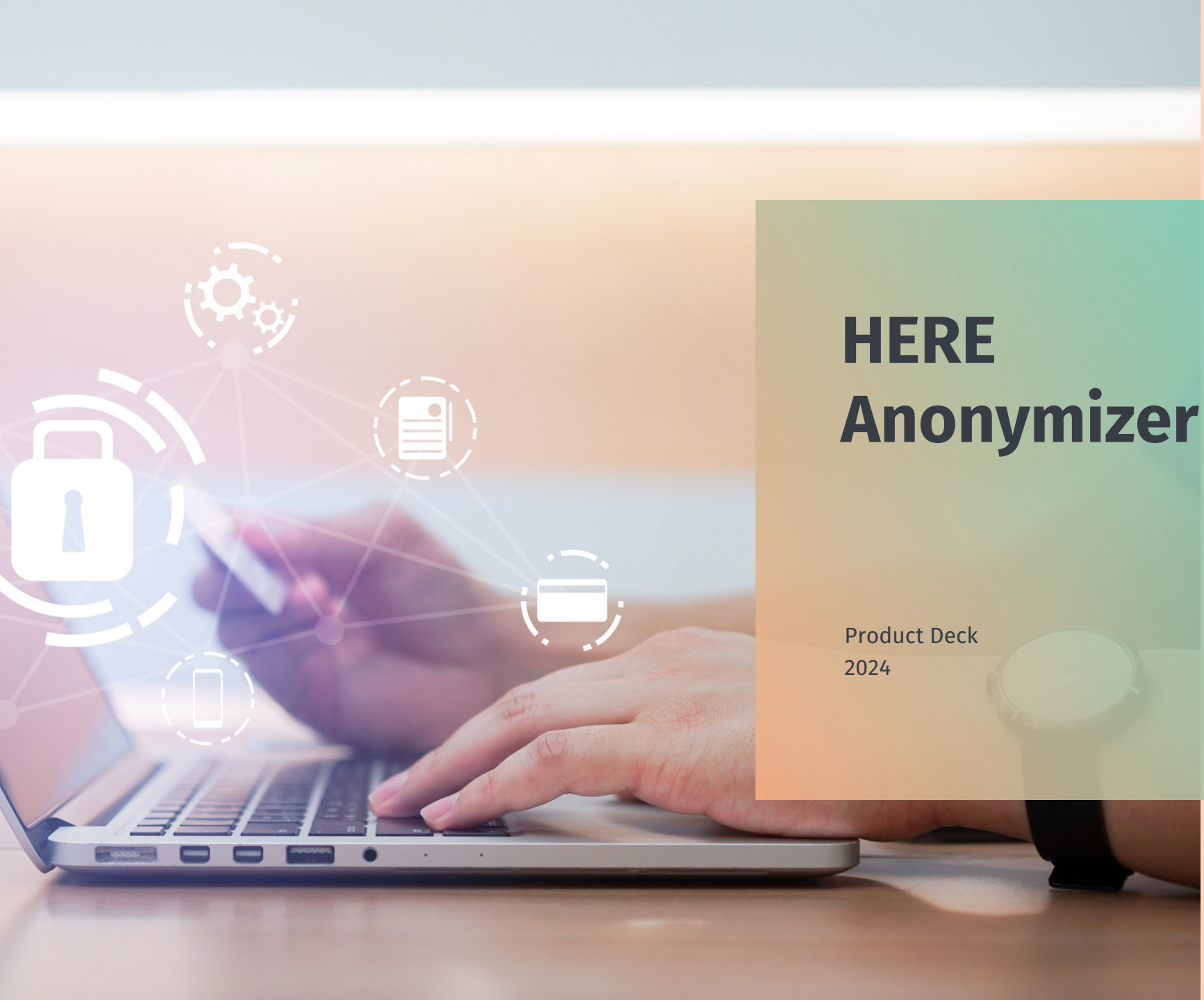

# HERE Anonymizer

Product Deck
2024

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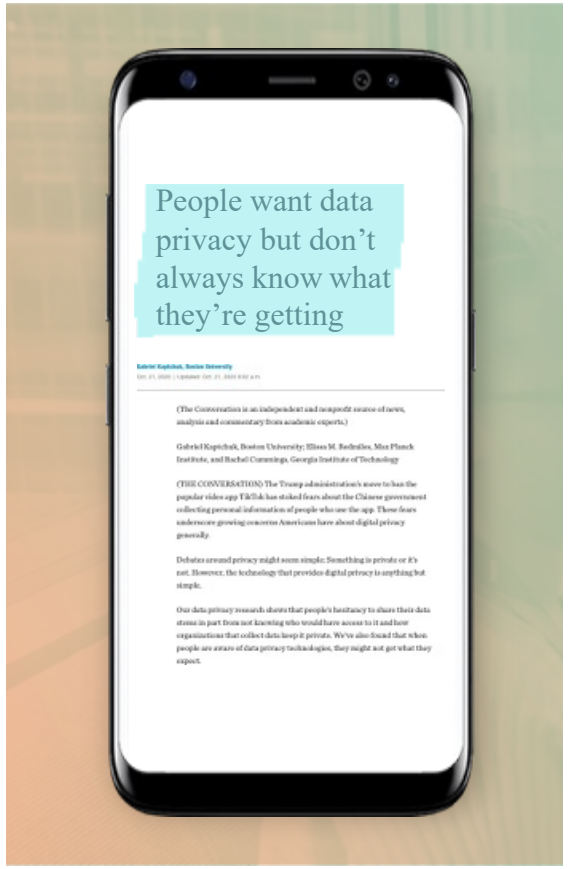
# Agenda

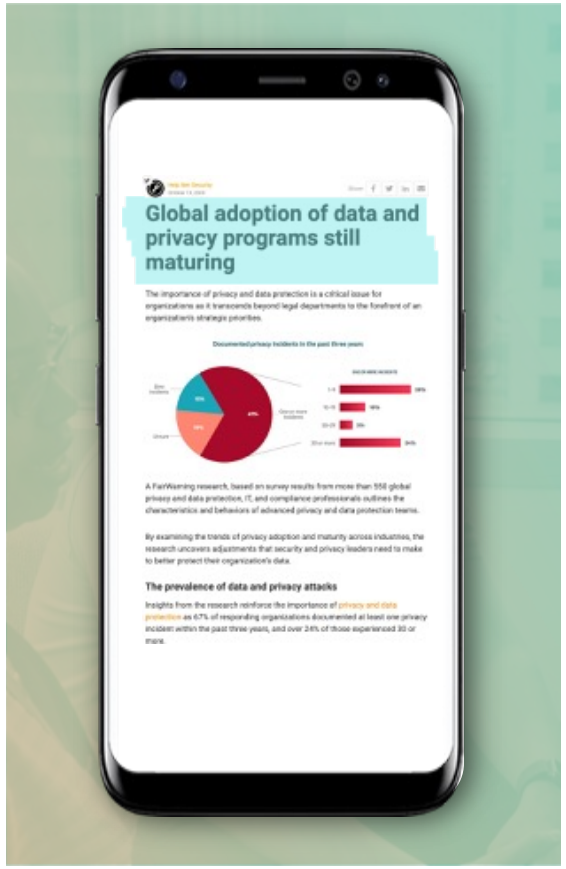


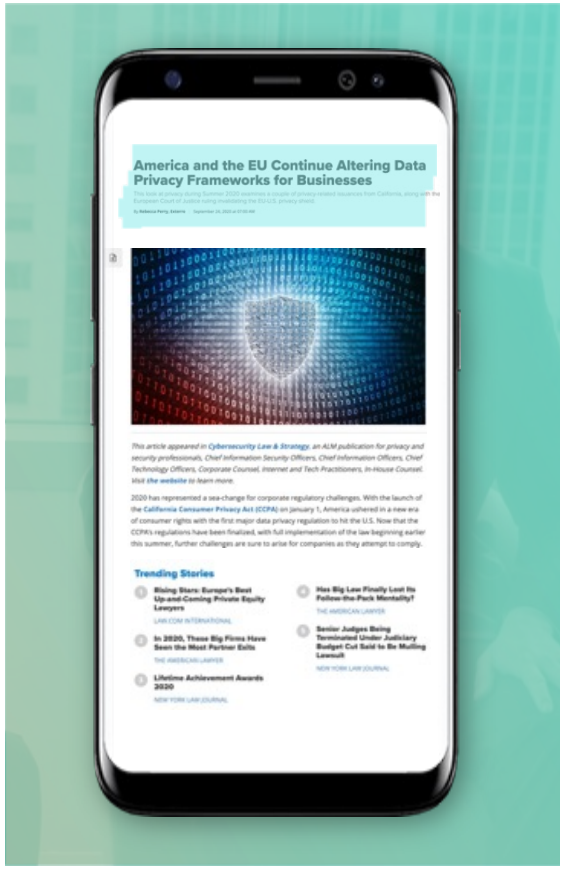
01.

# Market overview

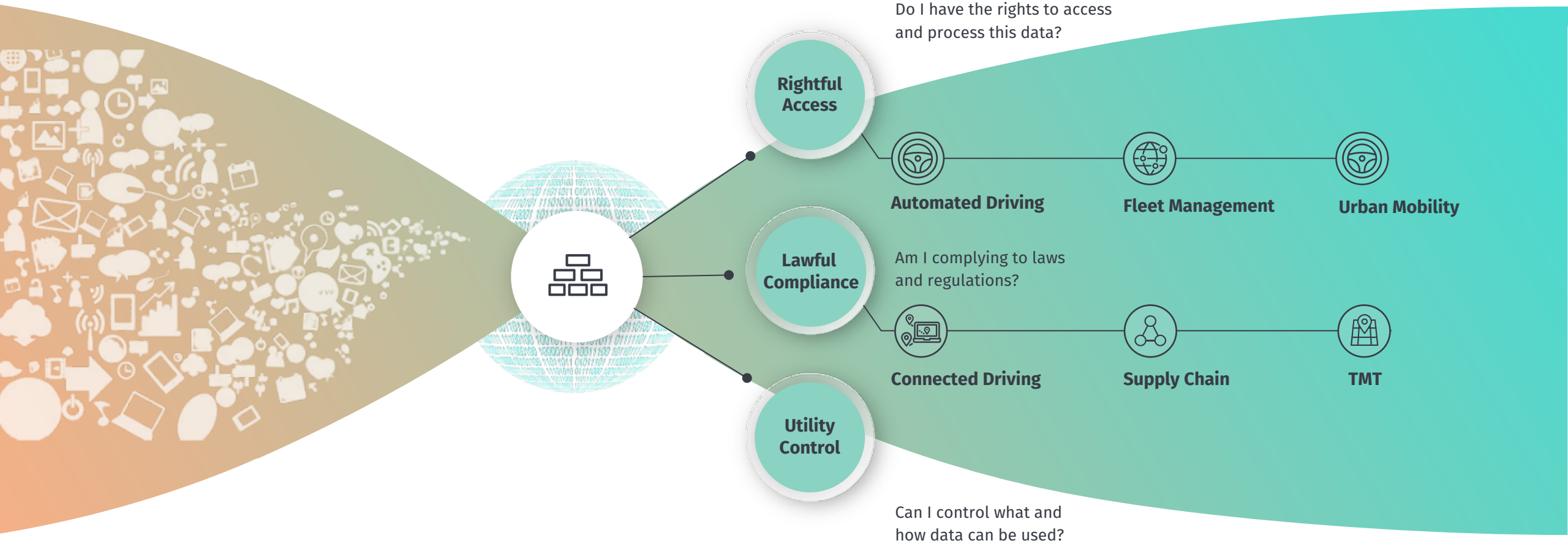
# Increasing media coverage highlights the growing importance of data privacy amongst enterprises and customers




# After GDPR introduction, user's consent and anonymization are mandatory to enable key PII use-cases



# Enterprises jump over additional hurdles before they can get to insights

**Compliance with data privacy legislations and privacy risk mitigation is critical to any company.**

**Data privacy tools and processes no longer considered just for compliance, but seen as a potential competitive differentiation**

# Location data is particularly privacy sensitive and challenging to anonymize

## Extremely revealing

Location information has two components – **spatial and temporal**. Location data describes probability to be “at the right time at the right place”. Additionally, it has been shown that human mobility patterns are unique and predictable - With 4 randomly chosen points in a trajectory you can re-identify 95% of people with a pseudonym.

## Technically challenging


Location data is particularly technically challenging due to its sequential nature, spatiotemporal inter-data relations, rich semantic meaning behind it and publicly available adversary knowledge.

02.

# Product Overview

# HERE Anonymizer offering

HERE Anonymizer enables customers to process location data at scale while reducing the privacy risks associated with data. The product allows to preserve the maximum value and utility of data and complying with data privacy regulations.

**Processing of location data at scale while complying with privacy regulations (GDPR, CCPA, APPI).**

**Strike a balance between utility of the data and privacy levels.**

**Trust amongst various value chain participants by providing data source privacy protection.**

**Organizations avoid impact due to privacy breaches.**

# HERE Anonymizer overview

- The service is  offered in **two formats** to meet the different use cases and needs of our customers: *HERE Anonymizer Self-Hosted* and R*eal-Time Anonymizer* as a pipeline in the HERE platform.
- The product includes the following features:
  - **Calibration tool** that calculates utility metrics for anonymization strategies and provides guidance on anonymization strategies.
  - **Visualization tool** that displays data utility and user anonymity results.

# HERE Anonymization offering

Processing of location data at scale while complying with privacy regulations (GDPR, CPRA, APPI)

---

Trust amongst various value chain participants by providing data source privacy protection

---

Organizations avoid impact due to privacy breaches

**HERE Anonymizer Self-Hosted** enables customers to anonymize their probe and event data before it leaves their premises. This option renders the highest level of privacy, at a fixed licensing fee and is geared to larger customers with significant data anonymization needs.

**Real-Time Anonymization Pipeline** provides the convenience of sending the data to the HERE platform for anonymization of the customer's location data. This option is priced based on usage and geared towards smaller customers.

# Overview of Real-Time Anonymizer pipeline

- Provides a set of algorithms for performing anonymization of **trajectories (probe data primitives) and point-location-data (event data).**
- Real time Anonymizer utilizes different **anonymization methods depending upon the use-case and input data.**
- It enables customers to **customize the configuration settings** of the anonymization strategy to achieve the desired balance between privacy levels and data-utility.
- The customers can implement **real-time (stream) data as well as batch data.**
- Features of the service include:
  - **Loading location data:** The data can be loaded SENSORIS or SDII format. The data needs to be ingested into the HERE platform to be anonymized using HERE data catalogs.
  - Loading Use **Case / Data / Anonymization Method Config.**
  - **Performing Anonymization** of location data with specific method and parameters: The method is dependent upon the how the data is intended to be used. For developing traffic use-case we implement Split and Gap method.
  - **Outputting anonymized data:** The output anonymized data is published as SENSORIS/SDII data messages in a HERE Platform.

**Real-time configurable anonymization pipeline**

**Configurable Anonymization methods based on use-case and data type.**

**Data providers can evaluate different anonymization strategies for the modelled data utility and user anonymity metrics. Ensuring that they are continuously using the most suitable anonymization strategy.**

03.

# Technical Details

# User Anonymity Threats

## Origin Destination Identification:

**Risk:**

Departure/Arrival from a specific location can be identified (i.e., Driver X left from 6 Spring Lane at 8:32am).

## Reconstruction:

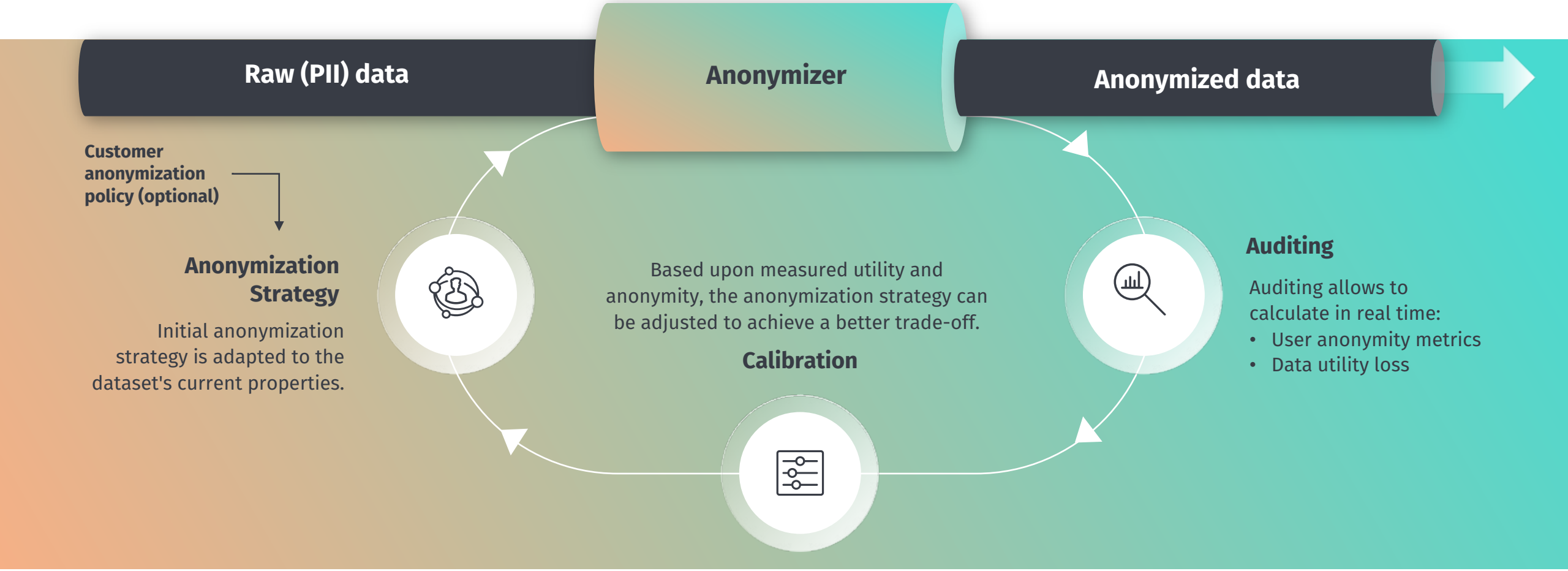
**Risk:**

Journey of a single user is able to be completely recreated from anonymized data (i.e., Driver X drove along a 12km track between 24 Church Road and 38 West Drive at 1:43pm).

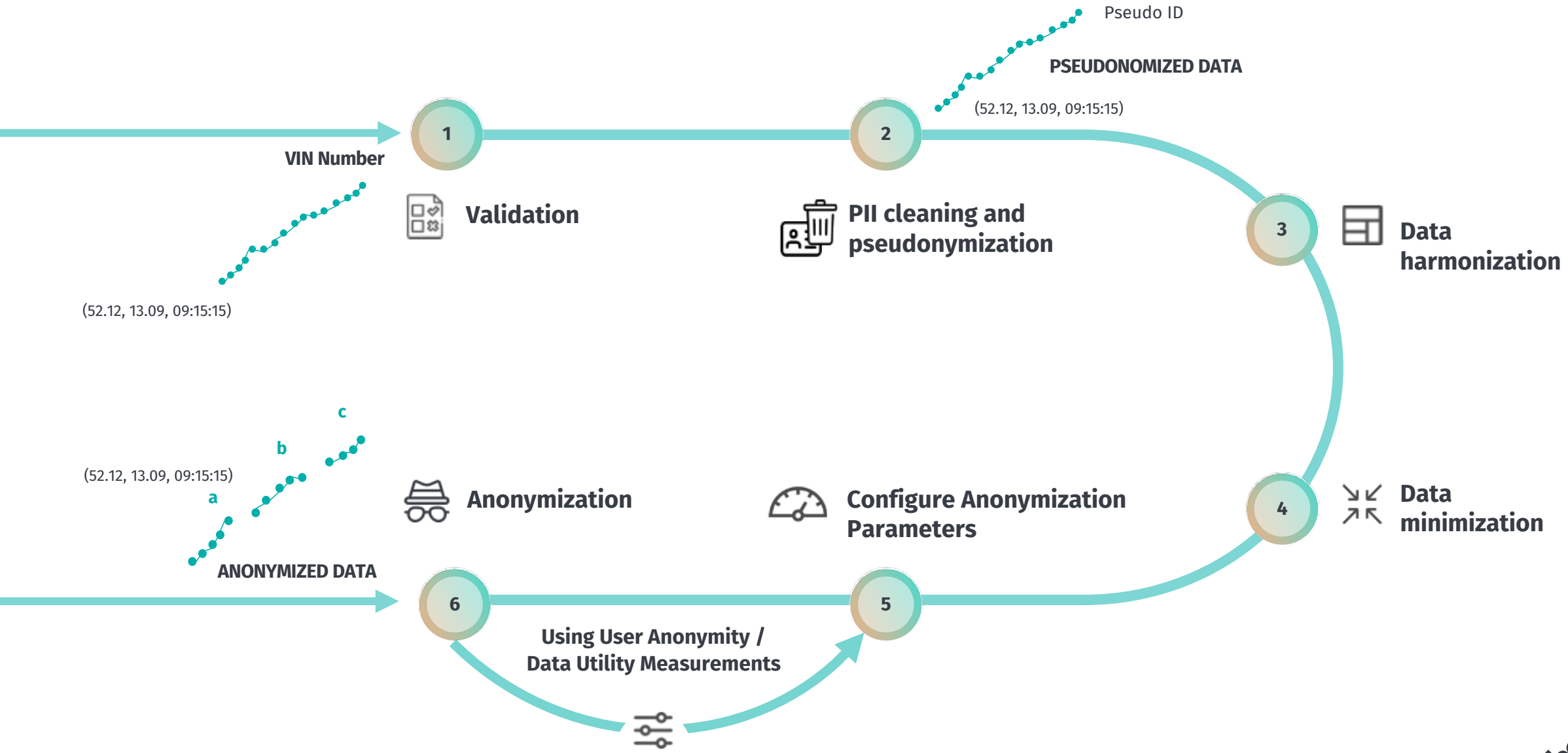
## Threats are used for:

- Identifying suitable anonymization strategies **(Anonymization Method).**
- Measuring success of anonymization strategies **(User Anonymity Metrics).**

# Location Data Anonymization Process



# Location Data Anonymization Process



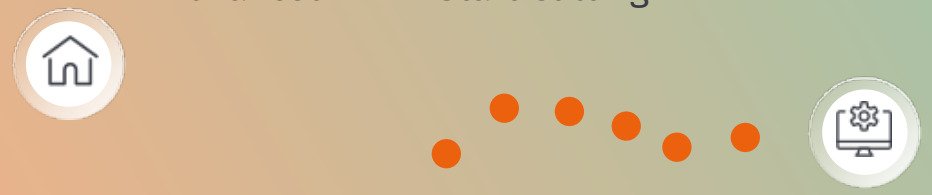
# HERE Anonymizer - Advanced Features

## Single Chunk or Time-based Start Cutting

Raw Trajectory Data

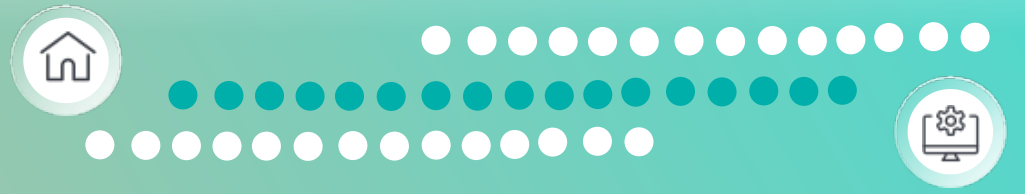
Industry Standard Start Cutting

Advanced HERE Start Cutting

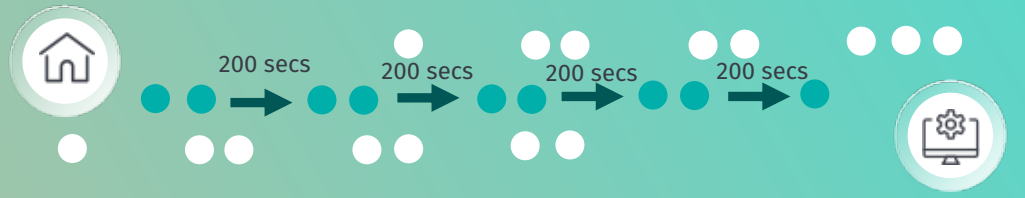


## Random Anonymization Parameter Values

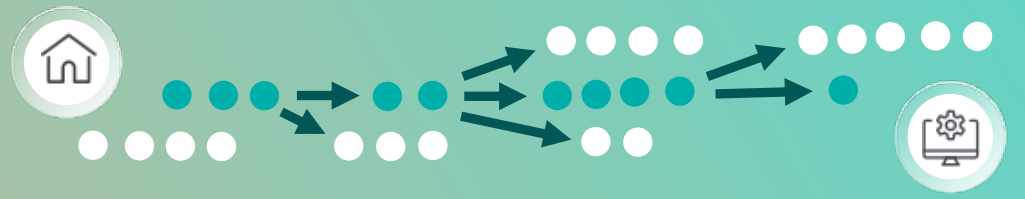
Raw Trajectory Data



Industry Standard Set Anonymization Parameter Values




Advanced HERE Start Cutting



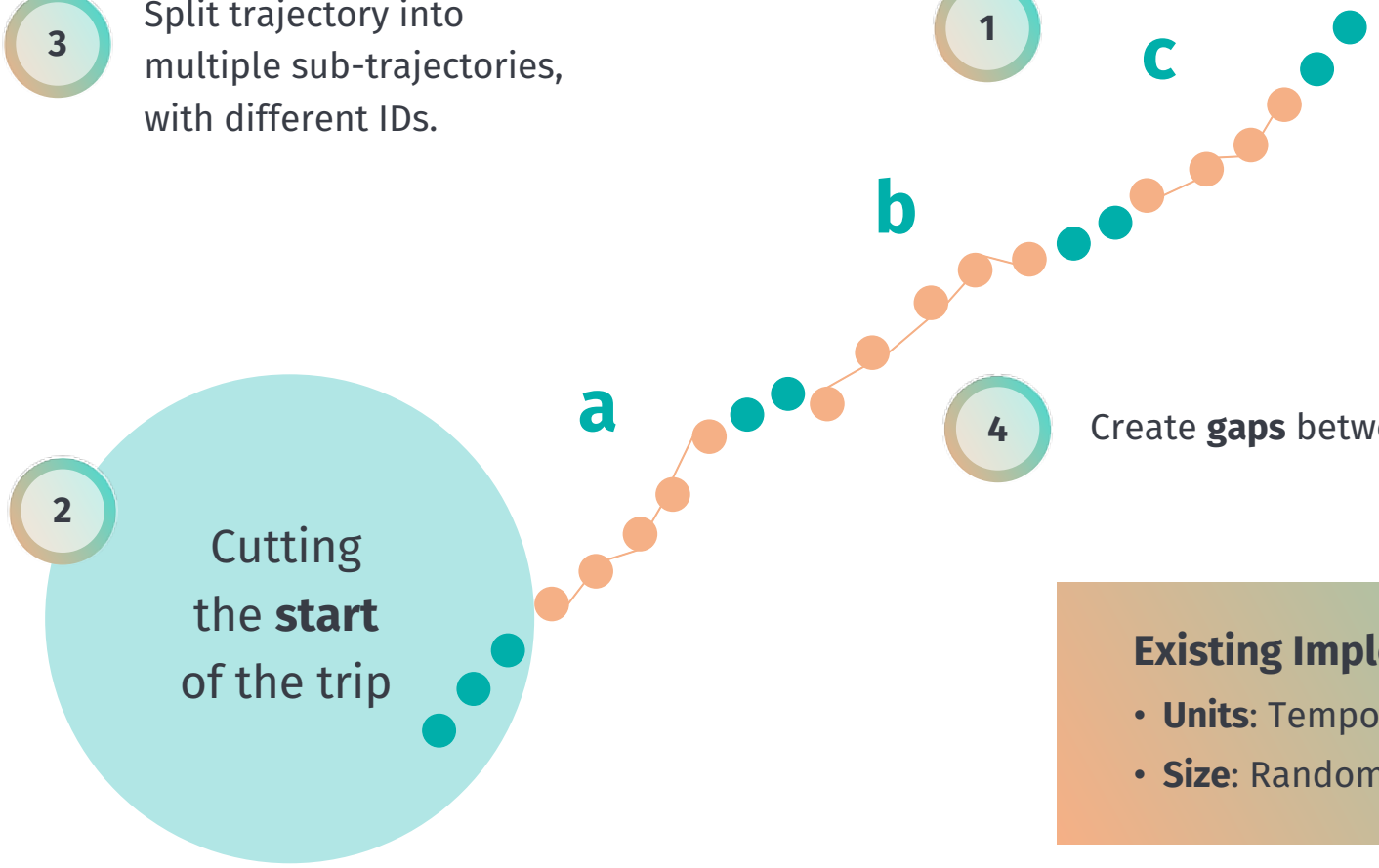
# Example Complete Trajectory Anonymization - Traffic UC

Subsampling trajectory

1

5 Predict and cut the end of trip prior to arrival to destination

3 Split trajectory into multiple sub-trajectories, with different IDs.



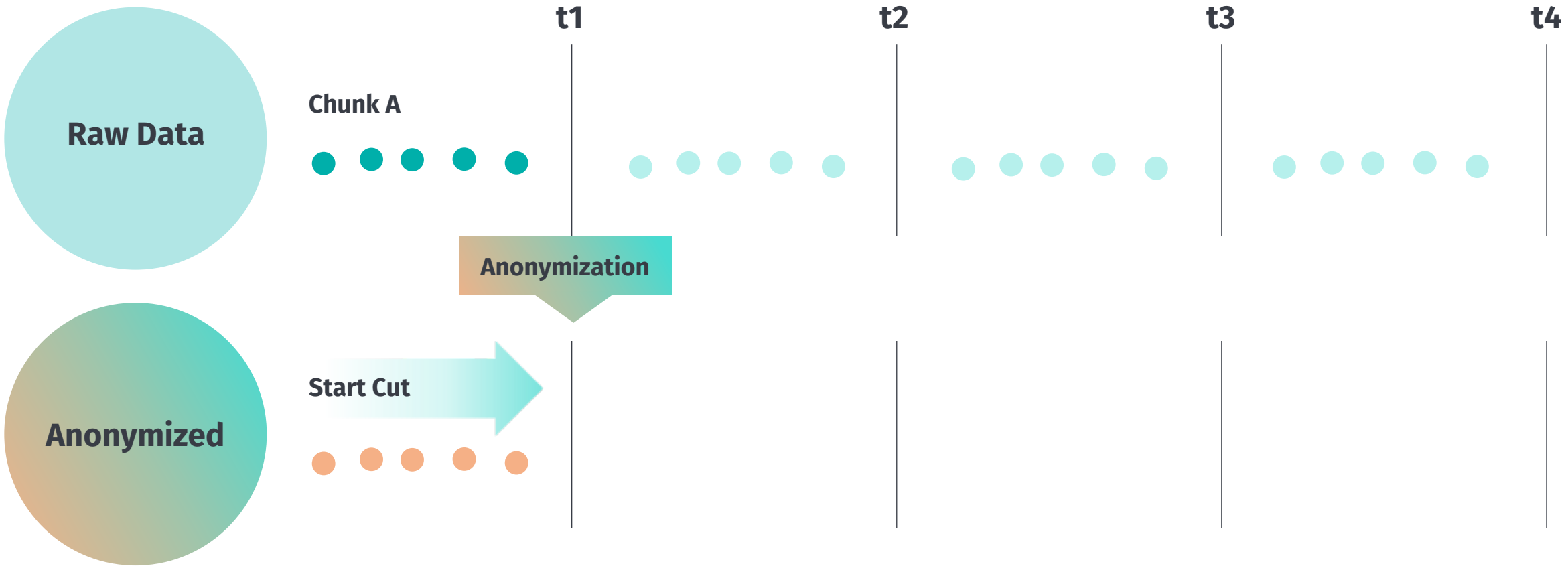

2 Cutting the **start** of the trip

4 Create **gaps** between sub-trajectories.

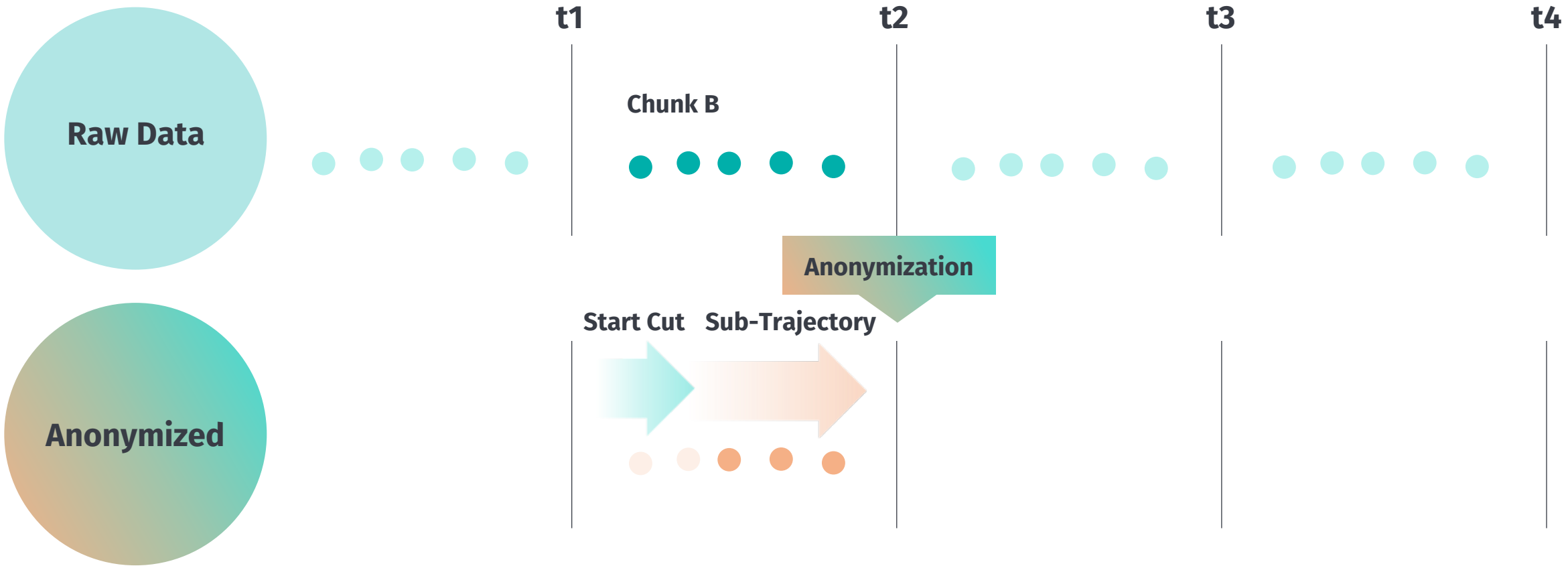
**Existing Implementation**

- **Units**: Temporal only
- **Size**: Randomly chosen size within given range

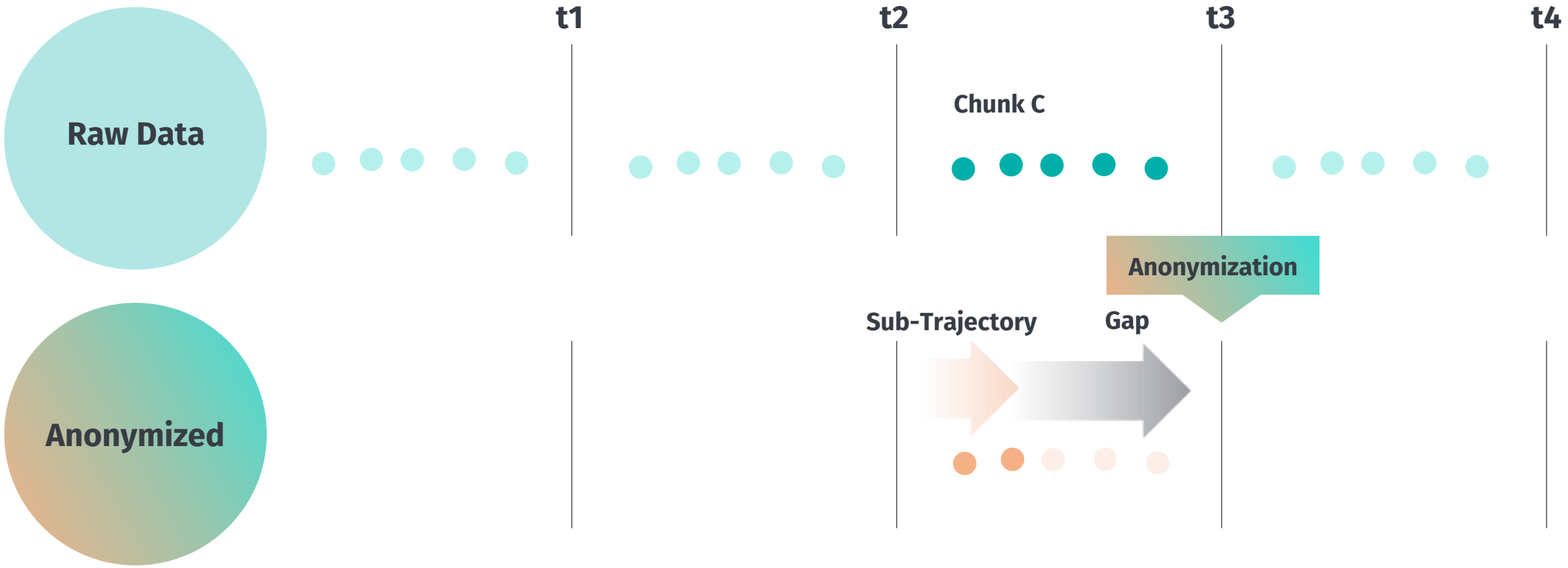
# Example Chunked Trajectory Anonymization - RTTI UC



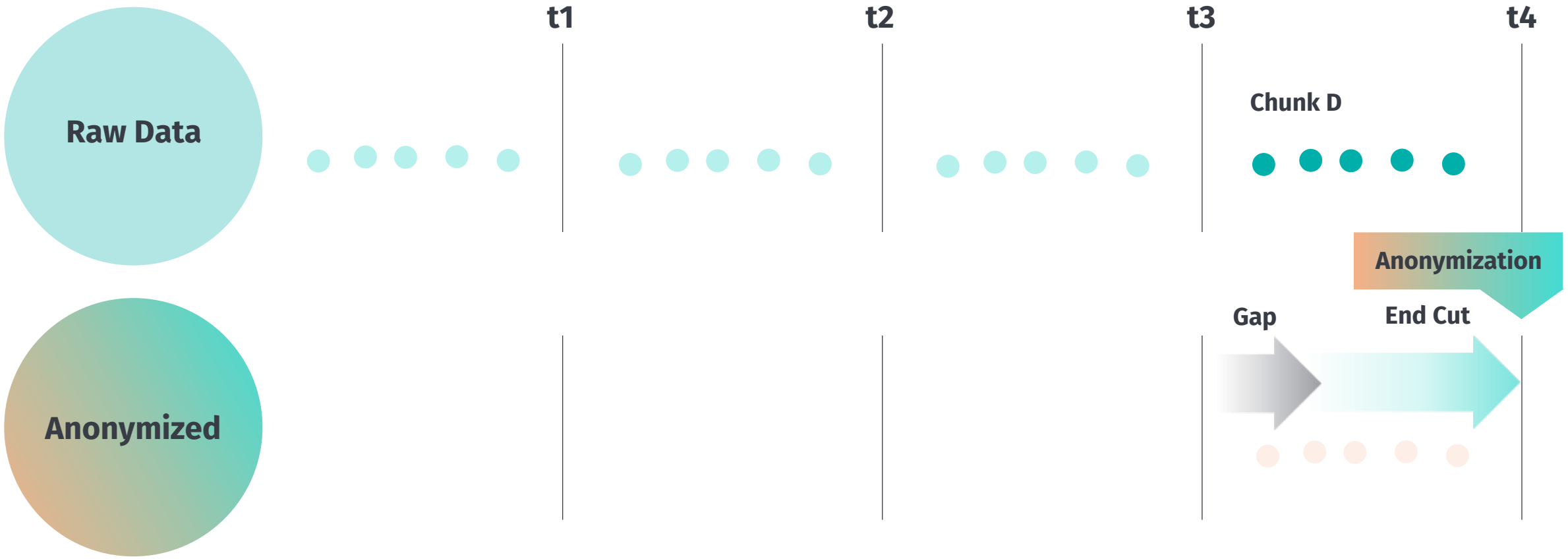
# Example Chunked Trajectory Anonymization - RTTI UC



# Example Chunked Trajectory Anonymization - RTTI UC



# Example Chunked Trajectory Anonymization - RTTI UC



# Anonymization Developments

**In order to be in line with GDPR requirements we have an in-house research team that is constantly:**

- Identifying **new Privacy Threats** (i.e., Attribute Linkage)
- Developing **new User Anonymity Metrics** for these threats (i.e., Stay Point Obfuscation)
- **Improving Anonymization Strategies** against these threats (i.e., End Anonymization)

**Expanding from single Data Provider for Traffic Use Case including:**

- Handling **new Use Cases** (i.e., Hazard)
- Handling **multiple Use Cases** (i.e., Hazard and Traffic) from same data source
- Handling **Data Pools** (multiple Data Providers anonymized together)

04.

# Value proposition

# Value proposition

| | |
|---|---|
| **For:** | Data providers |
| **Who:** | Process location data at scale while reducing the privacy risks associated with data and preserving the maximum value and utility of data |
| **The:** | HERE Anonymizer |
| **Is:** | An on-platform pipeline and a self-hosted solution |
| **That:** | Uses state of the art advanced spatial algorithms to reduce the privacy risk and maximize the data value |
| **Unlike:** | Otonomo, IBM Mobi, and Privitar, Teralytics, TomTom, Cuebiq, SafeGuard |

## **HERE Anonymizer** enables

- Use case specific anonymization method for the data providers to select.
- Configurable anonymization method – allowing method to be changed as volume / distribution of data evolves over time.
- Supports real time and archived data anonymization.
- Provides privacy diagnostics for location data.

05.

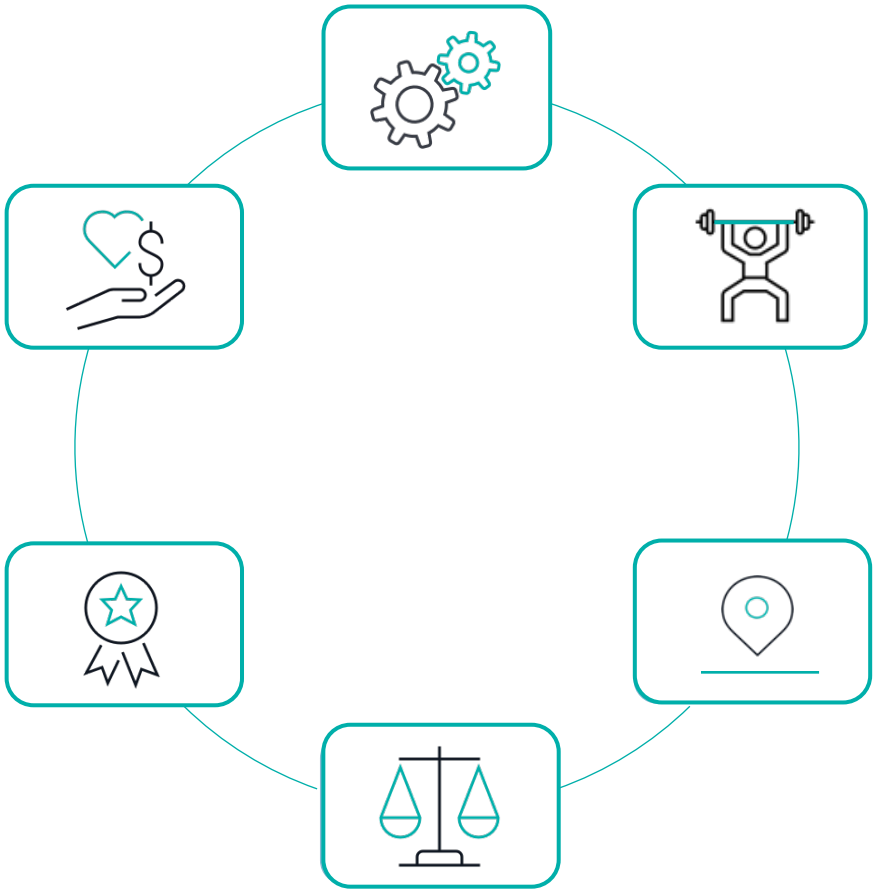
# Product differentiators

# HERE Anonymizer

## Product differentiators

### Integral component of the HERE platform

HERE Anonymizer is available as a pipeline within the HERE platform. Customers can benefit from a single one-stop shop for all their Location centric development and monetization needs.



### Customizability & flexibility

HERE Anonymizer provides configurable Anonymization methods based on use-case and data type. This flexibility enables customers to set the anonymization parameters to meet their business needs.

### Solution robustness

HERE's privacy solution uses advanced anonymization techniques built on a scalable platform and dedicated research into location data anonymization.

### Competitive feature set

HERE Anonymizer offers privacy diagnostics combined with solutions, such as visualization and calibration tools that are beyond proven competitor offerings.

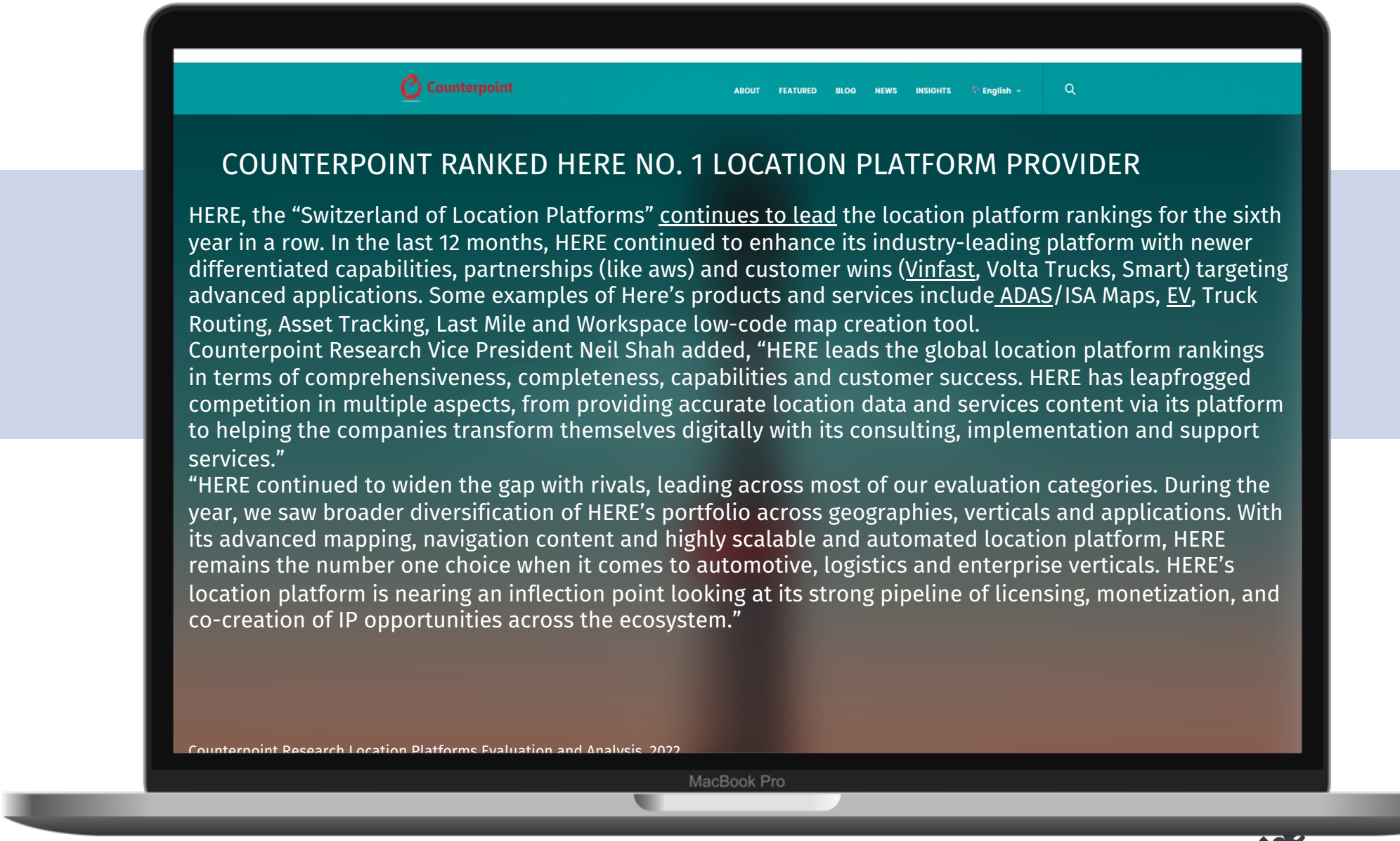
### Location expertise

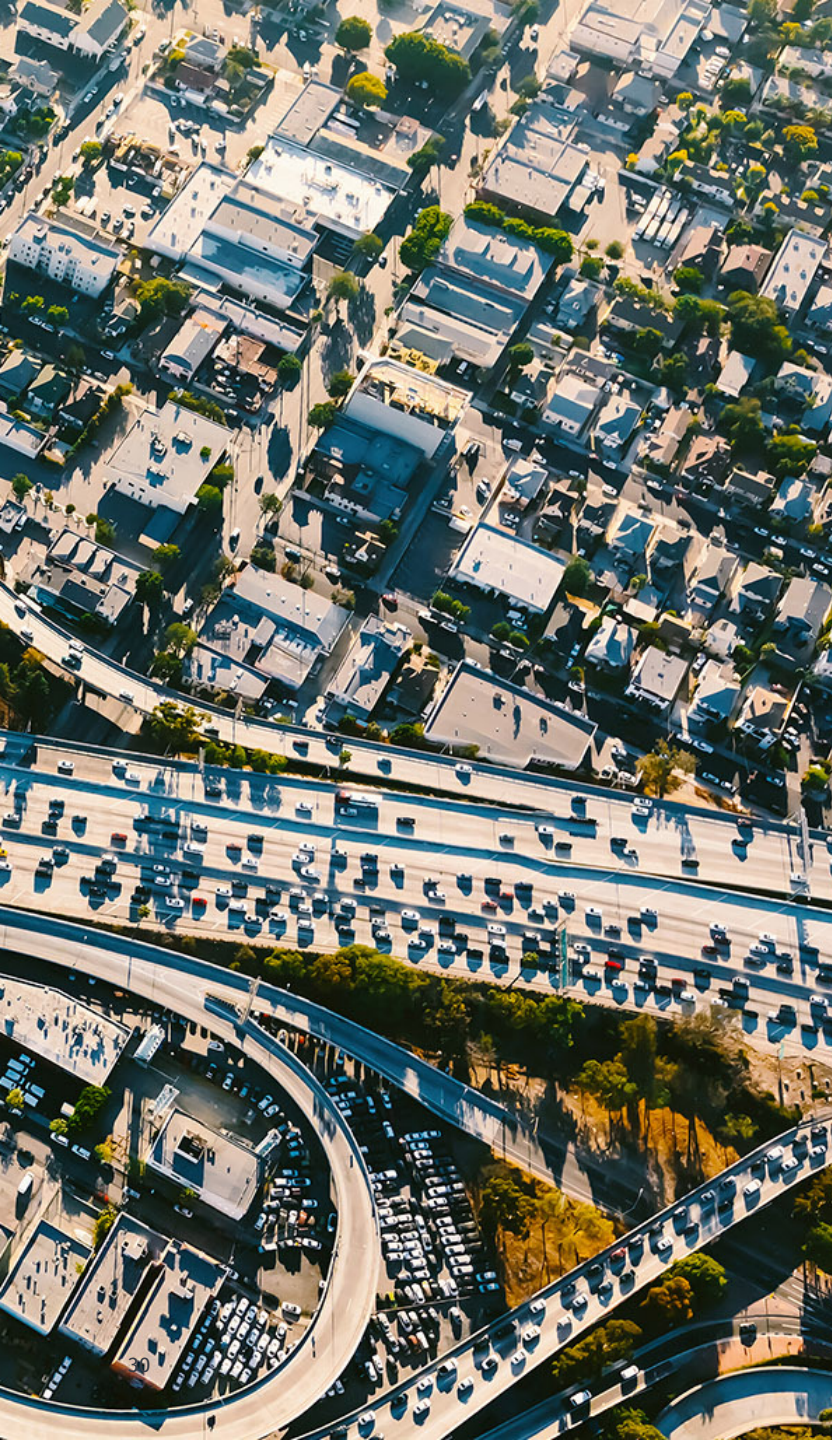
HERE has a long legacy of handling location centric data. In addition, there is a strong in-house expertise on privacy of location-centric data.

### HERE brand and neutrality

HERE has brand recognition for being a trusted partner and having a neutral position in the ecosystem.

# Counterpoint, Jan 2023





# Important product facts

## HERE Anonymizer

| | |
|---|---|
| **Output Format:** | Fat JAR |
| **Frequency update** | Monthly |
| **Delivery:** | Via HERE Marketplace |
| **Geographic coverage** | Global |
| **Online/offline** | HERE Anonymizer Self-Hosted can be used online and off-line. It can be run online or without internet connection in Azure, AWS or soon in Google Cloud. |

06.

# Applicable markets

# HERE Anonymizer can be used by customers in multiple markets

## Transport & Logistics

To safeguard any private transactions or confidential information so that it cannot be associated with any one business

## Media

To protect the personal identity, avoid personal harassment & disclosure of sensitive information of media users

## Retail

To protect personal information collected during financial transactions by physical or on-line retailers

## Public Sector

To protect personal information collected to provide public services from theft/fraud

## Tech/Research

Safe data analysis to enhance customer experience without compromising the individual's identity

## Telco

To safeguard telephone and data transmission records from induvial and corporate customers

## Automotive

To protect drivers and pedestrians' privacy whose records might be among data captured by connected vehicles in public roads

07.

# Use cases

# Market Use Cases

| Market | Use Case | Details |
|---|---|---|
|  **All markets** | Data Monetization | Generate new revenue streams by selling probe data directly to HERE or other customers |
| | Data Exchange | Facilitate the exchange and sharing of data with trusted ecosystem participants |
|  **Fleet Management** | Optimization of commercial vehicle routes, dynamic updates to routes, ETA prediction | Anonymization needed for customer's private data, e.g., locations of private POIs, movement of commercial vehicles outside and in-yard |
| | Analyze efficiency of pick-up and drop-off | Create efficiency by optimizing pick-up and drop-off zones to avoid tickets, risky driver manoeuvres and user road crossing |
| | Commercial vehicle visibility | Anonymization needed when vehicle and driver location is exchanged between commercial carrier and other parties like customers, etc. |
|  **Urban Mobility** | Ride planning / demand management | Analyse fleet movement and areas of demand to better understand fleet operations, define operational zone and deploy fleet accordingly |
| | Driver and passenger safety | Use movement and event data to learn about hotspots of riskier and incident-prone driving, including wrong way driving |
| | Analyze efficiency of pick-up and drop-off | Create efficiency by optimizing pick-up and drop-off zones to avoid tickets, risky driver manoeuvres and user road crossing |
| | Occupancy based routing | Visualize data flow in transport hubs and understand clearly where people gather and transport is needed so that service offering, and frequency can be adjusted accordingly |
|  **Connected & Automated Driving** | Understand traffic flows and real-time events | Create and enhance connected services such as Traffic, Hazard Warnings, Road Safety services, Emergency services, Parking using anonymized probe data from own vehicles and mobile devices<br>Traffic - anonymized probe data for traffic flow<br>Parking - anonymized probe to understand movement of cars in parking garages / lots<br>Safety services - anonymized probe data to build or enhance services like speed limit warnings, hazard warnings, etc. |
| | EV Traffic Flow Analysis | Understand for own brand EV driving patterns and areas with high EV density for charging station planning |

# Fleet Management

## **Target audience** (data providers)

End-customers in:

- T&L industry (3PLs, CEPs).
- Retail industry (online retailers, click n mortars).
- Manufacturing industry (chemical manufacturers, building material manufacturers, auto OEMs, etc.)

## Data Set / Type:

- Raw probe data from vehicles or mobile devices.
- Event data.

## Data Consumers:

- FMS companies.
- Insurance companies.

| **Use case** | **Details** | **Can be combined with** | **Data Consumer** (key buying center) |
|---|---|---|---|
| **Optimization of commercial vehicle routes, dynamic updates to routes, ETA prediction** | Anonymization needed for customer's private data, e.g., locations of private POIs, movement of commercial vehicles outside and in-yard. | HERE Probe Data<br>Flow Modeling | Commercial carriers<br>FMS companies |
| **Driver behavior analysis** | Anonymization needed when driver driving records are exchanged between commercial carrier (employer of drivers) and insurance companies or data processing firms. | HERE Probe Data<br>HERE Traffic | Commercial carriers<br>Insurance companies |
| **Analyze efficiency of pick-up and drop-off** | Create efficiency by optimizing pick-up and drop-off zones to avoid tickets, risky driver manoeuvres and user road crossing. | HERE Probe Data | Commercial carriers |
| **Commercial vehicle visibility** | Anonymization needed when vehicle and driver location is exchanged between commercial carrier and other parties like customers, etc. | | |
| **Data Monetization** | Generate new revenue streams by selling probe data directly to HERE or other customers. | | Buyers across industries |
| **Data Exchange** | Facilitate the exchange and sharing of data with trusted ecosystem participants. | Data Enrichment | Eco-system partners (cross industry, e.g. municipalities, cities) |

# Urban Mobility

## **Target audience** (data providers)

Operators of public transportation, ride-sharing and on-demand fleets, including public transit, taxi companies, ridesharing and pooling.

## Data Set / Type:

- Raw probe data from vehicles or mobile devices.

## Data Consumers:

- Within Urban Mobility market.
- In other markets / and industries (e.g., public sector, infrastructure planning).

| Use case | Details | Can be combined with | Data Consumer (key buying center) |
|---|---|---|---|
| **Ride planning / demand management** | Analyse fleet movement and areas of demand to better understand fleet operations, define operational zone and deploy fleet accordingly. | HERE Probe Data Flow Modeling | Ride-hailing/sharing. |
| **Driver and passenger safety** | Use movement and event data to learn about hotspots of riskier and incident-prone driving, including wrong way driving. | HERE Probe Data HERE Traffic | Ride-hailing/sharing, public transport. |
| **Analyze efficiency of pick-up and drop-off** | Create efficiency by optimizing pick-up and drop-off zones to avoid tickets, risky driver manoeuvres and user road crossing. | HERE Probe Data | Ride-hailing/sharing. |
| **Occupancy based routing** | Visualize data flow in transport hubs and understand clearly where people gather, and transport is needed so that service offering, and frequency can be adjusted accordingly. | HERE Probe Data Flow Modeling | Public Transport, e.g. bus service. |
| **Data Monetization** | Generate new revenue streams by selling probe data directly to HERE or other customers | | Marketplace buyers (cross industry). |
| **Data Exchange** | Facilitate the exchange and sharing of data with trusted ecosystem participants. | Data Enrichment | Eco-system partners (cross industry, e.g., municipalities, cities). |
| **Deliver efficient rides*** | Identify congestion hotspots and provide smarter and more timely information to drivers. | HERE Probe Data HERE Traffic | |
| **Population density based routing*** | Understand population density to identify where to install bus stops/ train station entrance. | | Public sector |

**To be validated with customer interactions*

# Connected & Automated Driving

**Target audience** (data providers)

- Passenger Car OEMs
- Truck OEMs.

**Data Set / Type:**

- Raw probe and event data from vehicles or mobile devices

**Data Consumers:**

- Same OEM that shared the data set.

| Use case | Details |
|---|---|
| Understand traffic flows and real-time events | Create and enhance connected services such as Traffic, Hazard Warnings, Road Safety services, Emergency services, Parking using anonymized probe data from own vehicles and mobile devices.<br>• Traffic - anonymized probe data for traffic flow<br>• Parking - anonymized probe to understand movement of cars in parking garages / lots<br>• Safety services - anonymized probe data to build or enhance services like speed limit warnings, hazard warnings, etc. |
| EV Traffic Flow Analysis | Understand for own brand EV driving patterns and areas with high EV density for charging station planning |

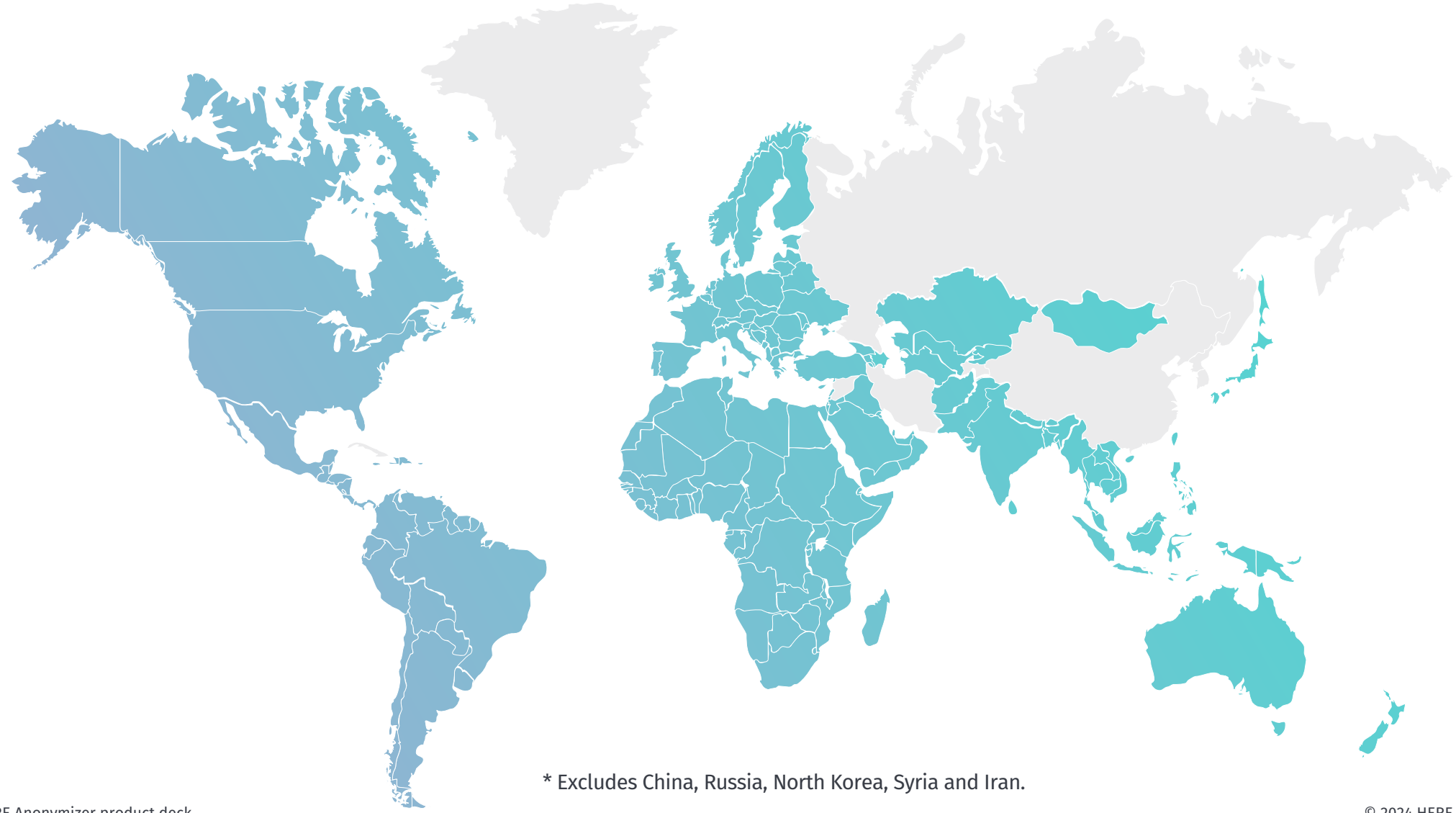
*To be validated with customer interactions

08.

# Coverage

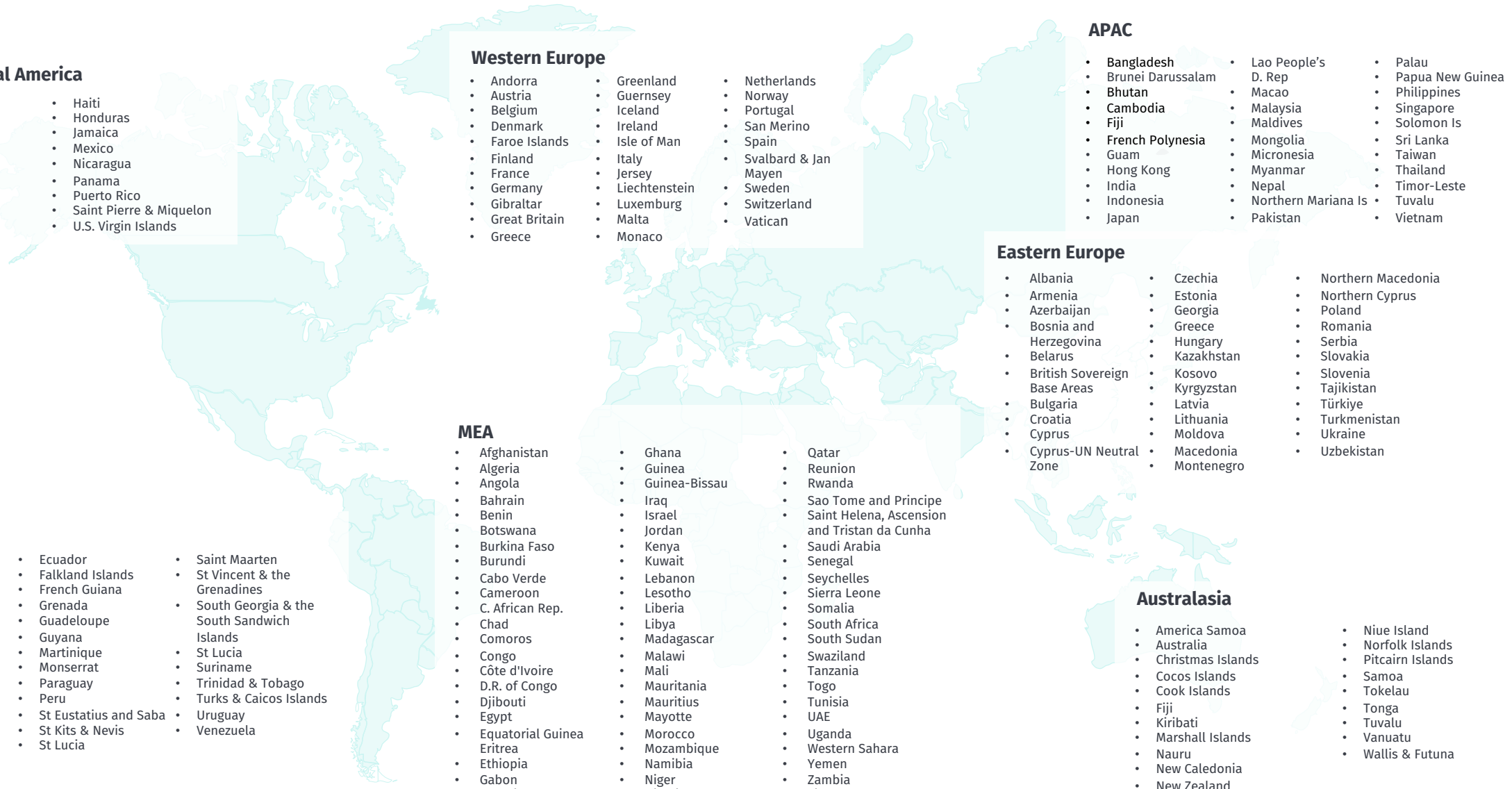
# HERE Anonymizer

## Global coverage*



* Excludes China, Russia, North Korea, Syria and Iran.

# Global coverage



## North & Central America

- USA
- Canada
- Bahamas
- Belize
- Bermuda
- Cayman Islands
- Costa Rica
- Dominican Rep.
- El Salvador
- Guatemala
- Haiti
- Honduras
- Jamaica
- Mexico
- Nicaragua
- Panama
- Puerto Rico
- Saint Pierre & Miquelon
- U.S. Virgin Islands

## Western Europe

- Andorra
- Austria
- Belgium
- Denmark
- Faroe Islands
- Finland
- France
- Germany
- Gibraltar
- Great Britain
- Greece
- Greenland
- Guernsey
- Iceland
- Ireland
- Isle of Man
- Italy
- Jersey
- Liechtenstein
- Luxemburg
- Malta
- Monaco
- Netherlands
- Norway
- Portugal
- San Merino
- Spain
- Svalbard & Jan Mayen
- Sweden
- Switzerland
- Vatican

## APAC

- Bangladesh
- Brunei Darussalam
- Bhutan
- Cambodia
- Fiji
- French Polynesia
- Guam
- Hong Kong
- India
- Indonesia
- Japan
- Lao People's D. Rep
- Macao
- Malaysia
- Maldives
- Mongolia
- Micronesia
- Myanmar
- Nepal
- Northern Mariana Is
- Pakistan
- Palau
- Papua New Guinea
- Philippines
- Singapore
- Solomon Is
- Sri Lanka
- Taiwan
- Thailand
- Timor-Leste
- Tuvalu
- Vietnam

## Eastern Europe

- Albania
- Armenia
- Azerbaijan
- Bosnia and Herzegovina
- Belarus
- British Sovereign Base Areas
- Bulgaria
- Croatia
- Cyprus
- Cyprus-UN Neutral Zone
- Czechia
- Estonia
- Georgia
- Greece
- Hungary
- Kazakhstan
- Kosovo
- Kyrgyzstan
- Latvia
- Lithuania
- Moldova
- Macedonia
- Montenegro
- Northern Macedonia
- Northern Cyprus
- Poland
- Romania
- Serbia
- Slovakia
- Slovenia
- Tajikistan
- Türkiye
- Turkmenistan
- Ukraine
- Uzbekistan

## MEA

- Afghanistan
- Algeria
- Angola
- Bahrain
- Benin
- Botswana
- Burkina Faso
- Burundi
- Cabo Verde
- Cameroon
- C. African Rep.
- Chad
- Comoros
- Congo
- Côte d'Ivoire
- D.R. of Congo
- Djibouti
- Egypt
- Equatorial Guinea
- Eritrea
- Ethiopia
- Gabon
- Gambia
- Gaza Strip
- Ghana
- Guinea
- Guinea-Bissau
- Iraq
- Israel
- Jordan
- Kenya
- Kuwait
- Lebanon
- Lesotho
- Liberia
- Libya
- Madagascar
- Malawi
- Mali
- Mauritania
- Mauritius
- Mayotte
- Morocco
- Mozambique
- Namibia
- Niger
- Nigeria
- Oman
- Qatar
- Reunion
- Rwanda
- Sao Tome and Principe
- Saint Helena, Ascension and Tristan da Cunha
- Saudi Arabia
- Senegal
- Seychelles
- Sierra Leone
- Somalia
- South Africa
- South Sudan
- Swaziland
- Tanzania
- Togo
- Tunisia
- UAE
- Uganda
- Western Sahara
- Yemen
- Zambia
- Zimbabwe

## South America

- Anguilla
- Antigua & Barbuda
- Argentina
- Aruba
- Barbados
- Bolivia
- Bonaire
- Brazil
- British Virgin Is
- Chile
- Colombia
- Curacao
- Dominica
- Ecuador
- Falkland Islands
- French Guiana
- Grenada
- Guadeloupe
- Guyana
- Martinique
- Monserrat
- Paraguay
- Peru
- St Eustatius and Saba
- St Kits & Nevis
- St Lucia
- Saint Maarten
- St Vincent & the Grenadines
- South Georgia & the South Sandwich Islands
- St Lucia
- Suriname
- Trinidad & Tobago
- Turks & Caicos Islands
- Uruguay
- Venezuela

## Australasia

- America Samoa
- Australia
- Christmas Islands
- Cocos Islands
- Cook Islands
- Fiji
- Kiribati
- Marshall Islands
- Nauru
- New Caledonia
- New Zealand
- Niue Island
- Norfolk Islands
- Pitcairn Islands
- Samoa
- Tokelau
- Tonga
- Tuvalu
- Vanuatu
- Wallis & Futuna

# Thank you

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