Twenty years of population projections using microsimulation at Statistics Canada

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Demosim and the projection of Canada's population diversity

Plan of the presentation

1. Genesis of Demosim
2. Overview
3. Policy-analysis tool
4. Future plans

Why and how Demosim was born

- Population estimates and projections are one of Statistics Canada's most important and long-standing statistical products
  - Ever-increasing appetite for actionable projection data with high granularity
  - Increasing population heterogeneity (diversity)

- Demosim was launched to meet key federal departments needs
  - Population projections by visible minority status, immigrant status, religious denominations, and mother tongue

Pre-Demosim Microsimulation Milestones at Statistics Canada

1984

- Social Policy Simulation Database and Model (SPSD/M)

1988

- Population Health Model (POHEM)

1992

- Personnel Simulation Model (PERSIM)

1993

- **Model Generator (ModGen)**

1993+

- POHEM
- LifePaths
- Others

2004

Demosim

Demosim: 20 years of development

Based on the **2001 Census**

- Immigrant status
- Ethnocultural variables

Rebased on the **2006 Census**

- Indigenous variables
- Education module

Rebased on the **2011 National Household Survey**

- Linguistic dimensions
- Religious affiliation

Rebased on the **2016 Census**

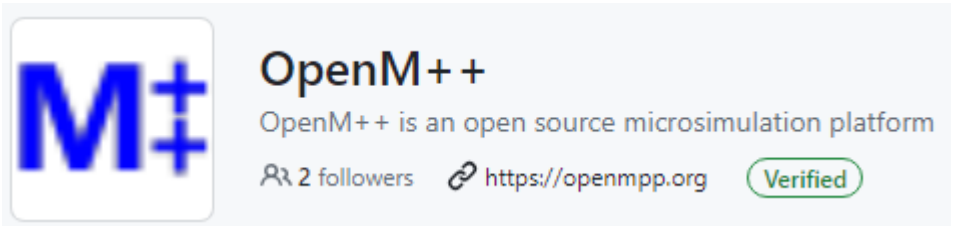
- Persons with disabilities

To be rebased on the **2021 Census**

- Gender
- Sex at birth

OpenM++

- Generic tool specifically designed to develop dynamic microsimulation models
- Open-source
- Manages the event queue
- Updates the waiting times
- Output user-defined tables



[OpenM++: open source microsimulation platform (openmpp.org)]

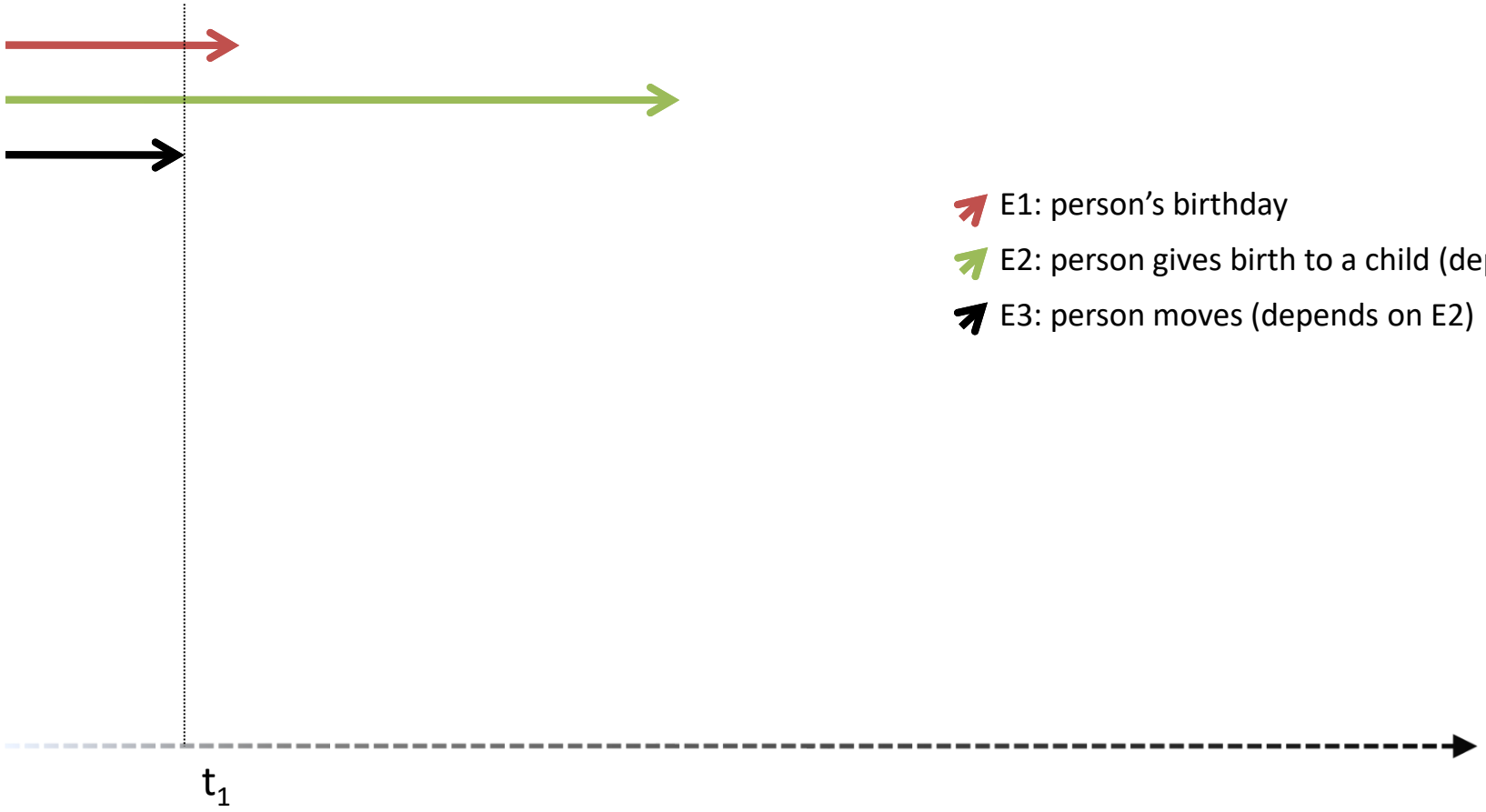
Demosim – An overview

- Population projection model
- Base population
  - Census microdata file
  - over 9 million records
- Case-based
- Continuous-time
- Dynamic
  - Risk of experiencing an event depends on characteristics
  - Characteristics change as time progresses
  - Risks are constantly reassessed

Competitive events and waiting times

- E1: person's birthday
- E2: person gives birth to a child (depends on E1)
- E3: person moves (depends on E2)

Competitive events and waiting times



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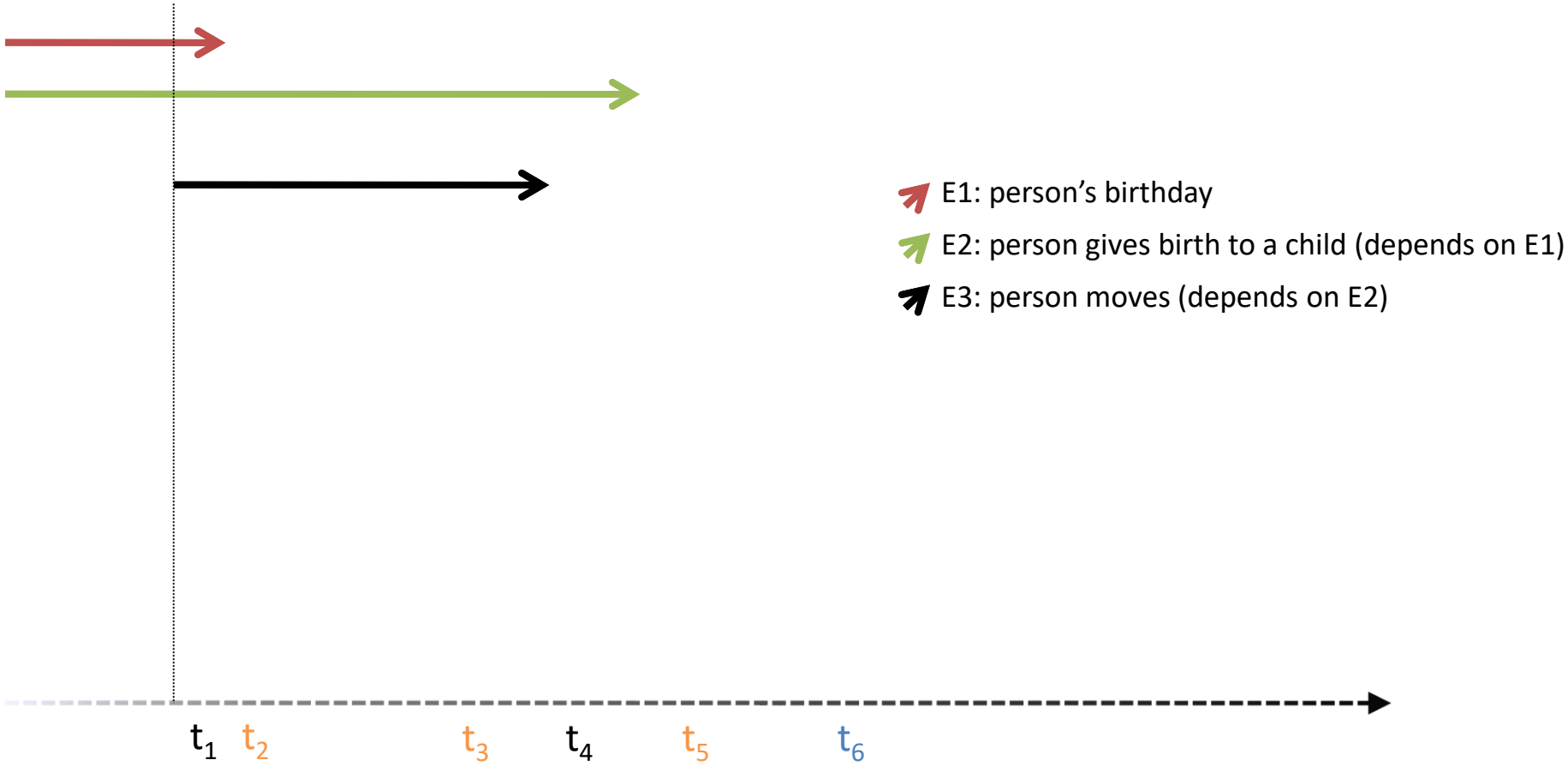

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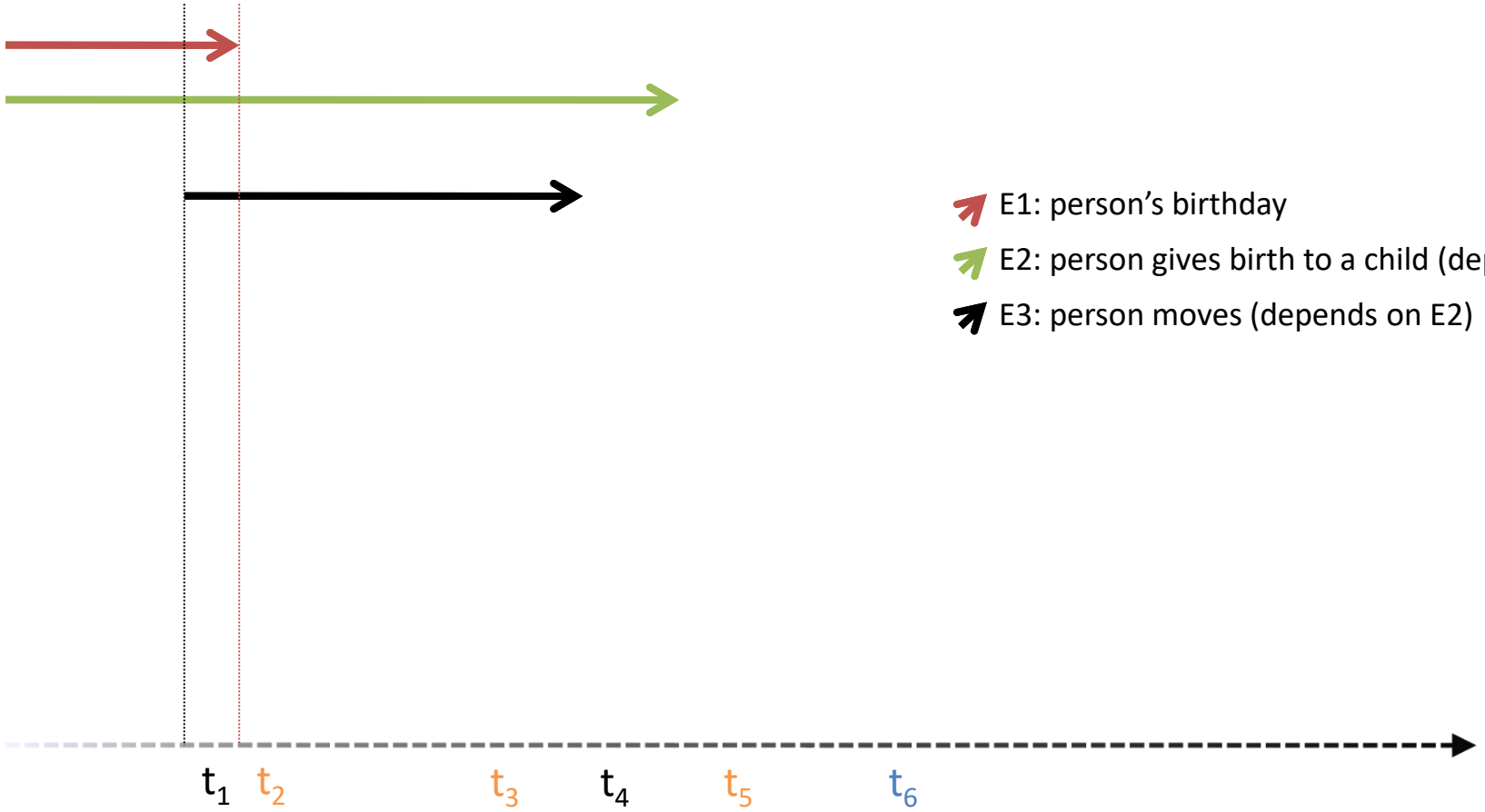

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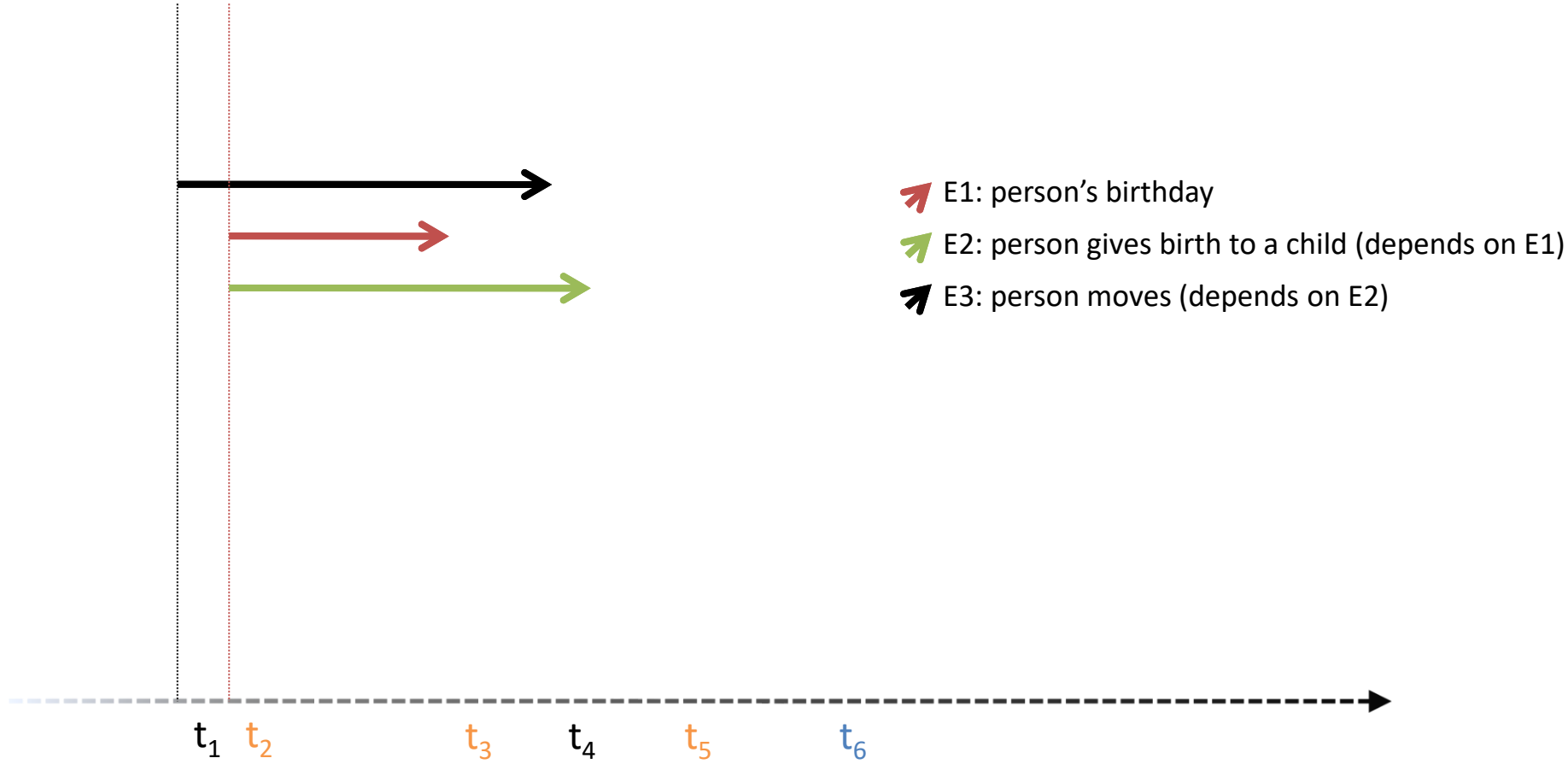

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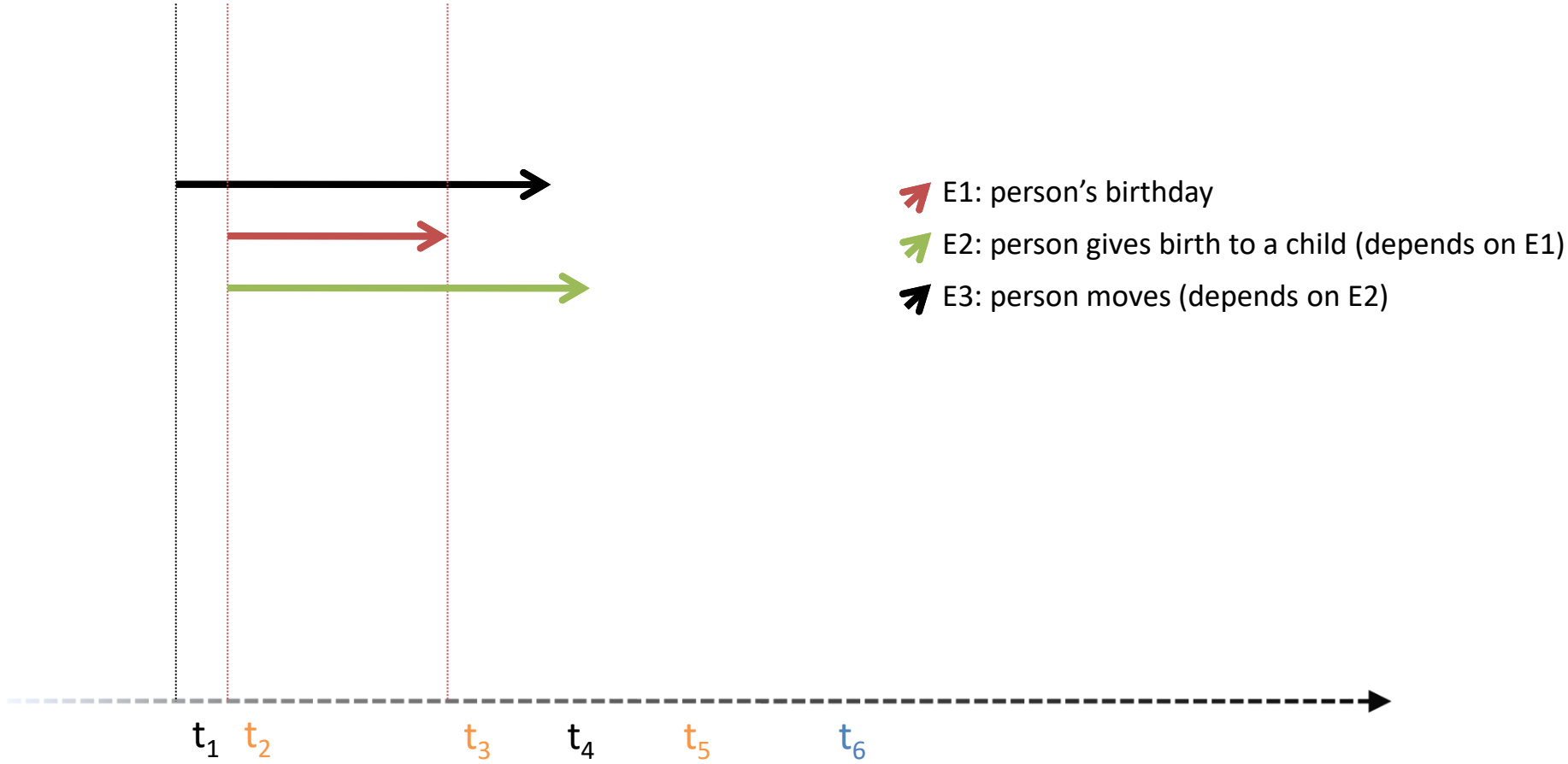

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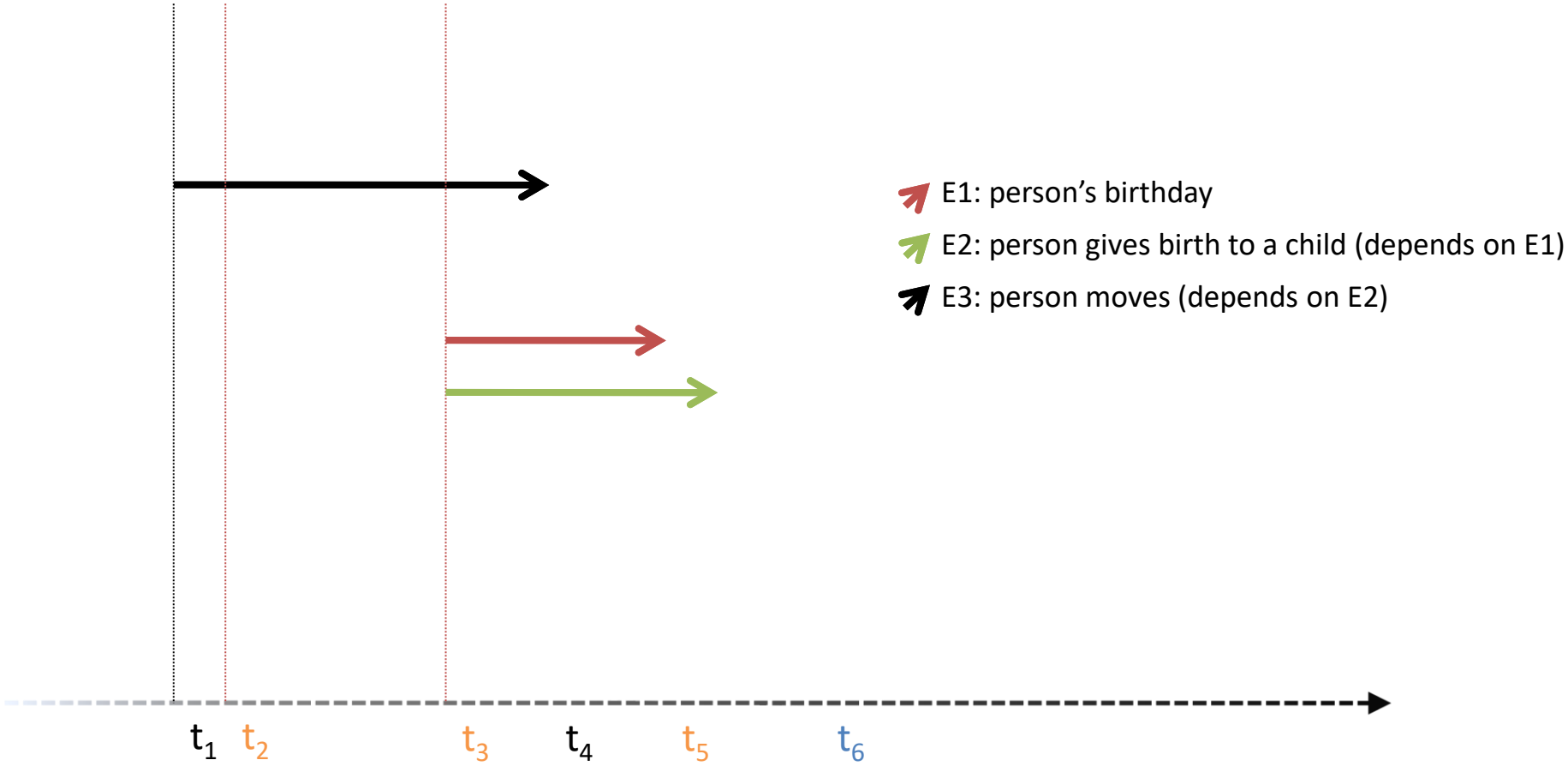

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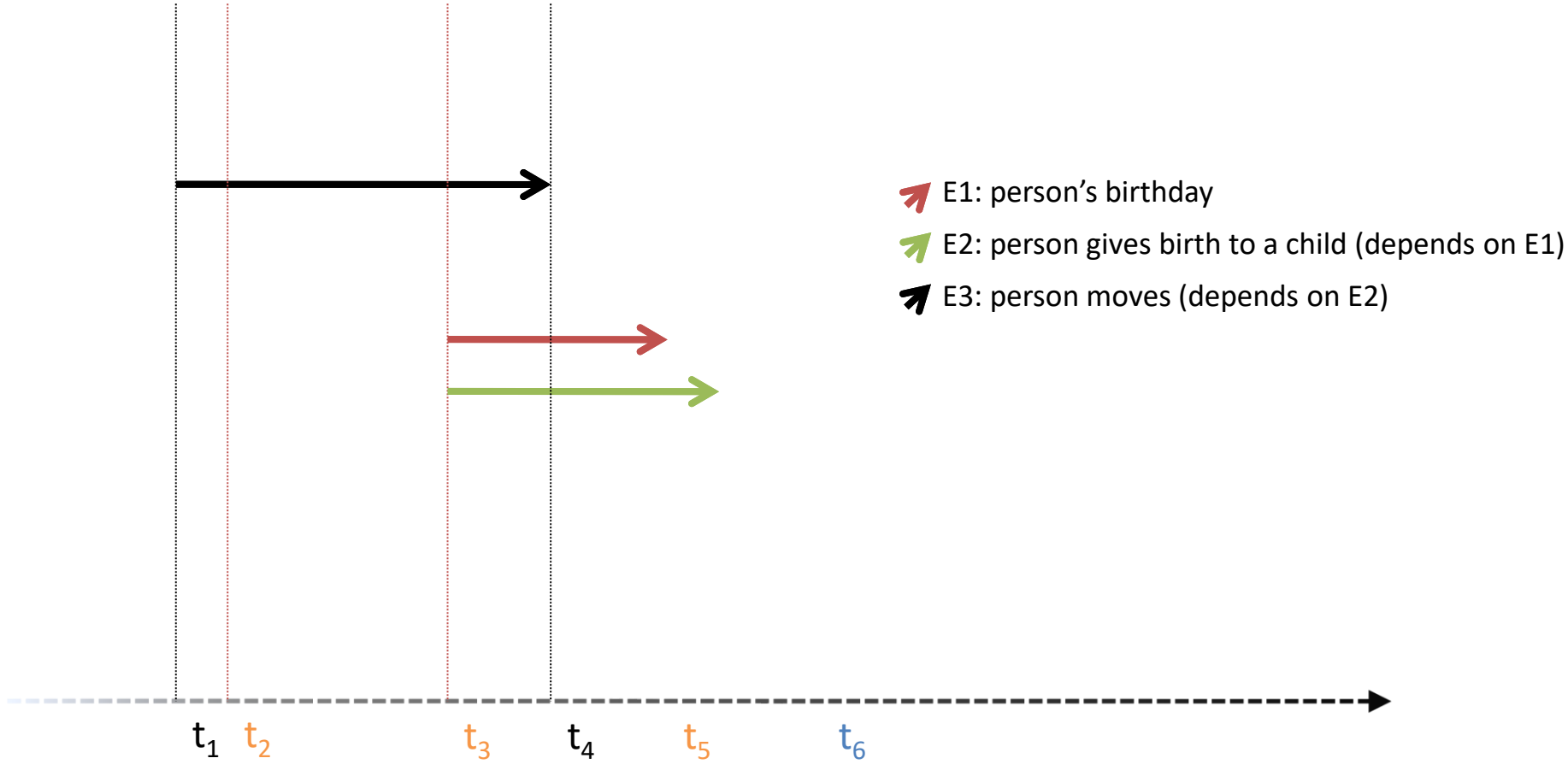

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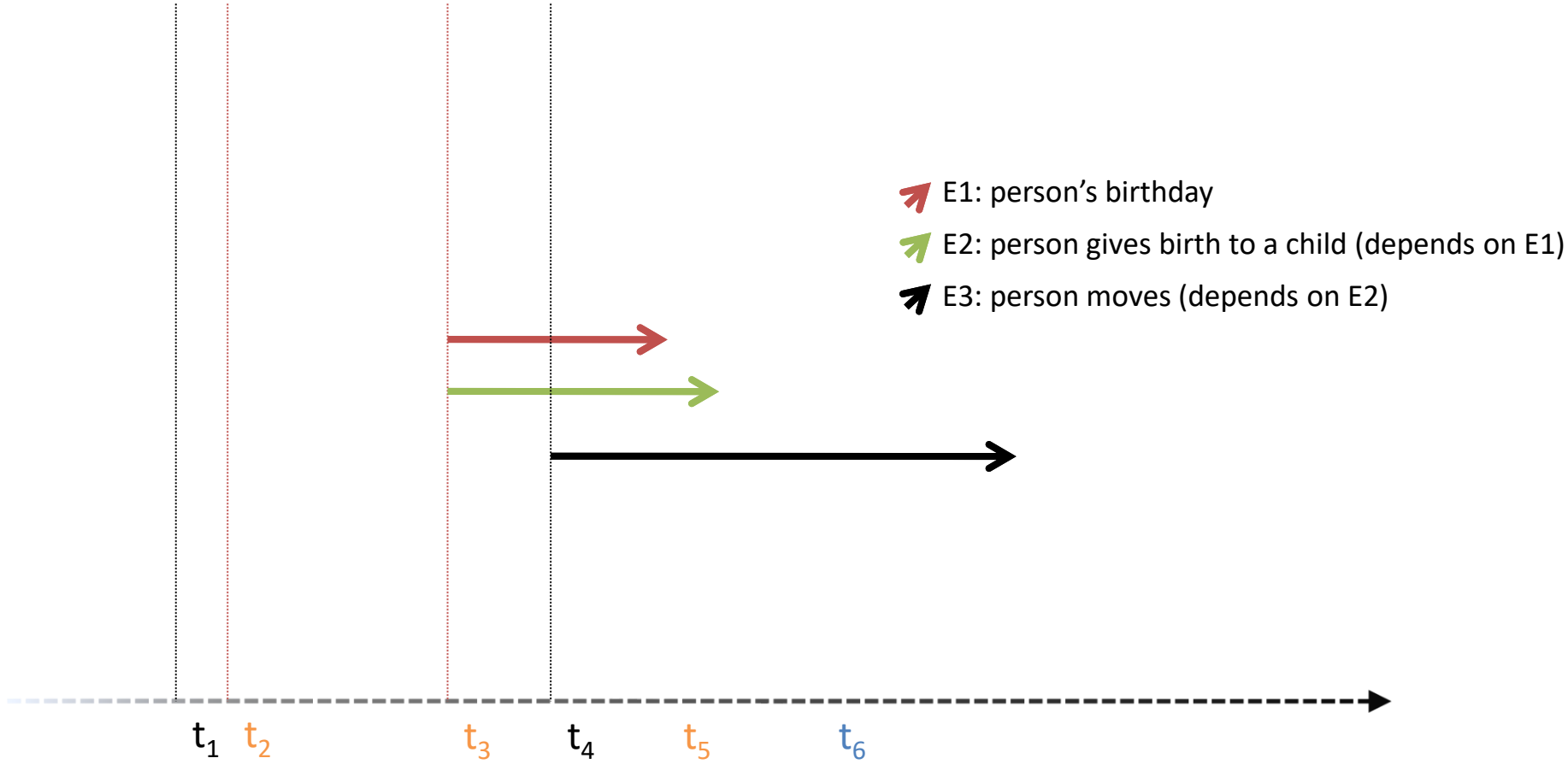

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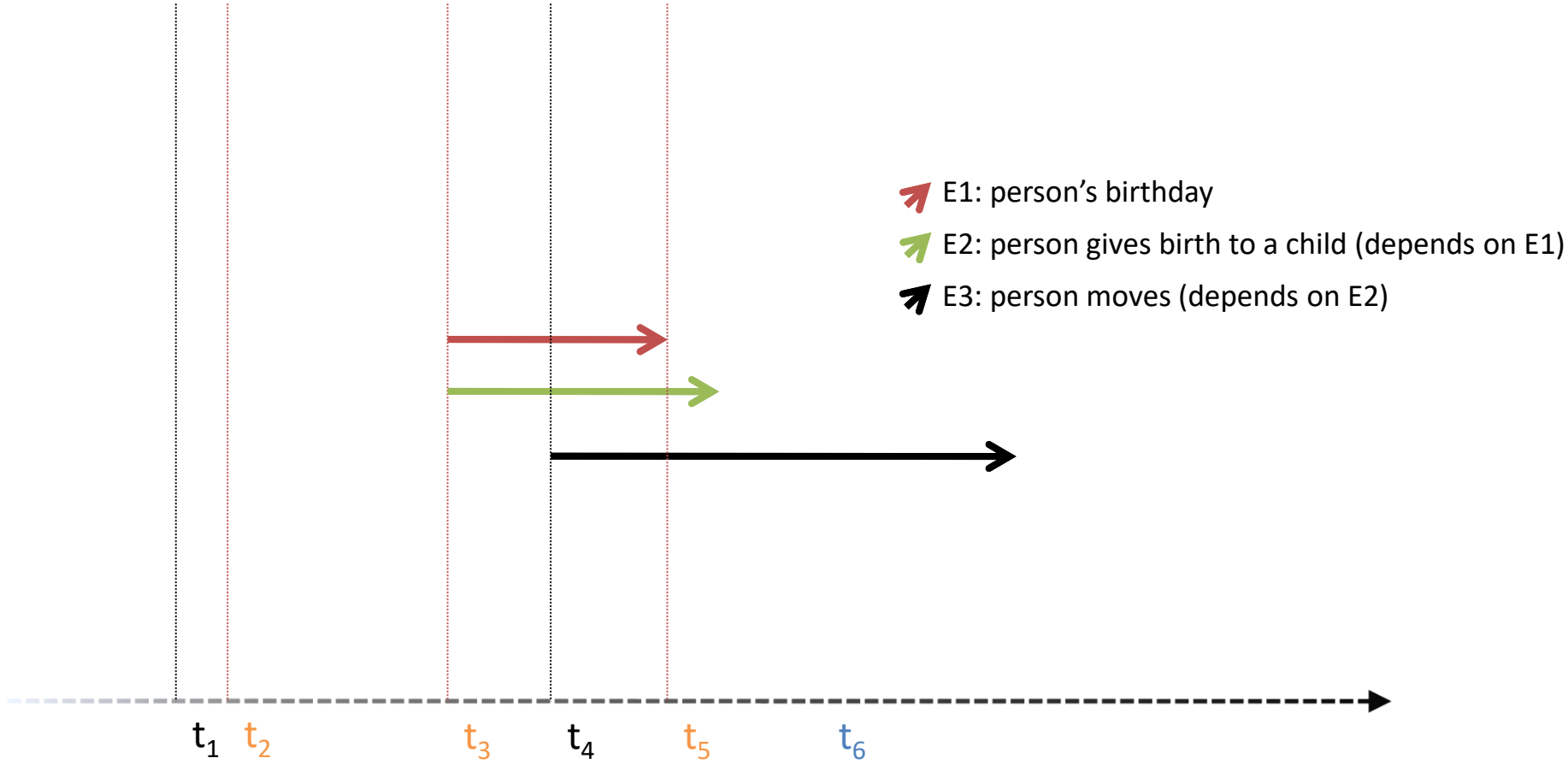

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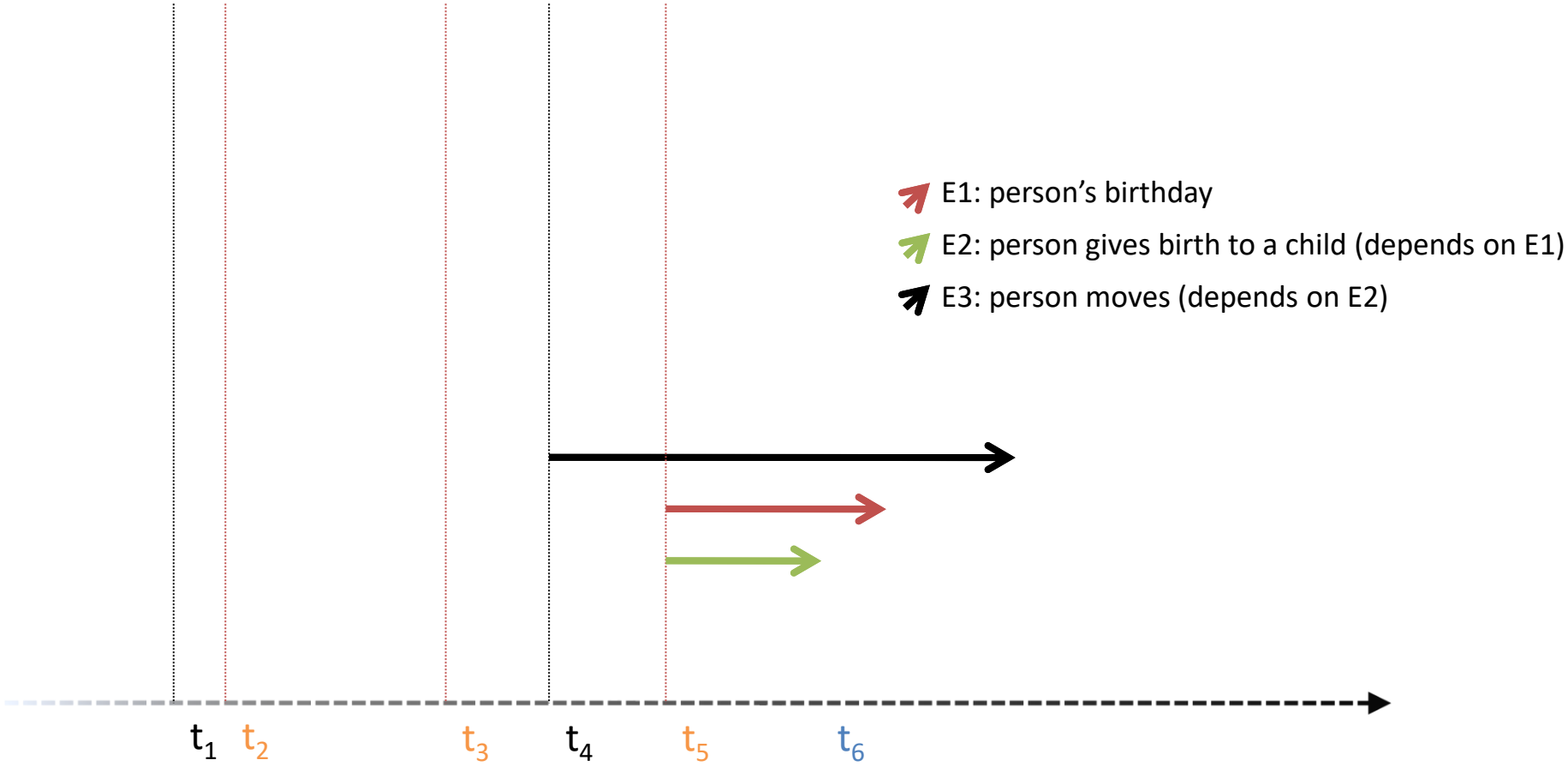

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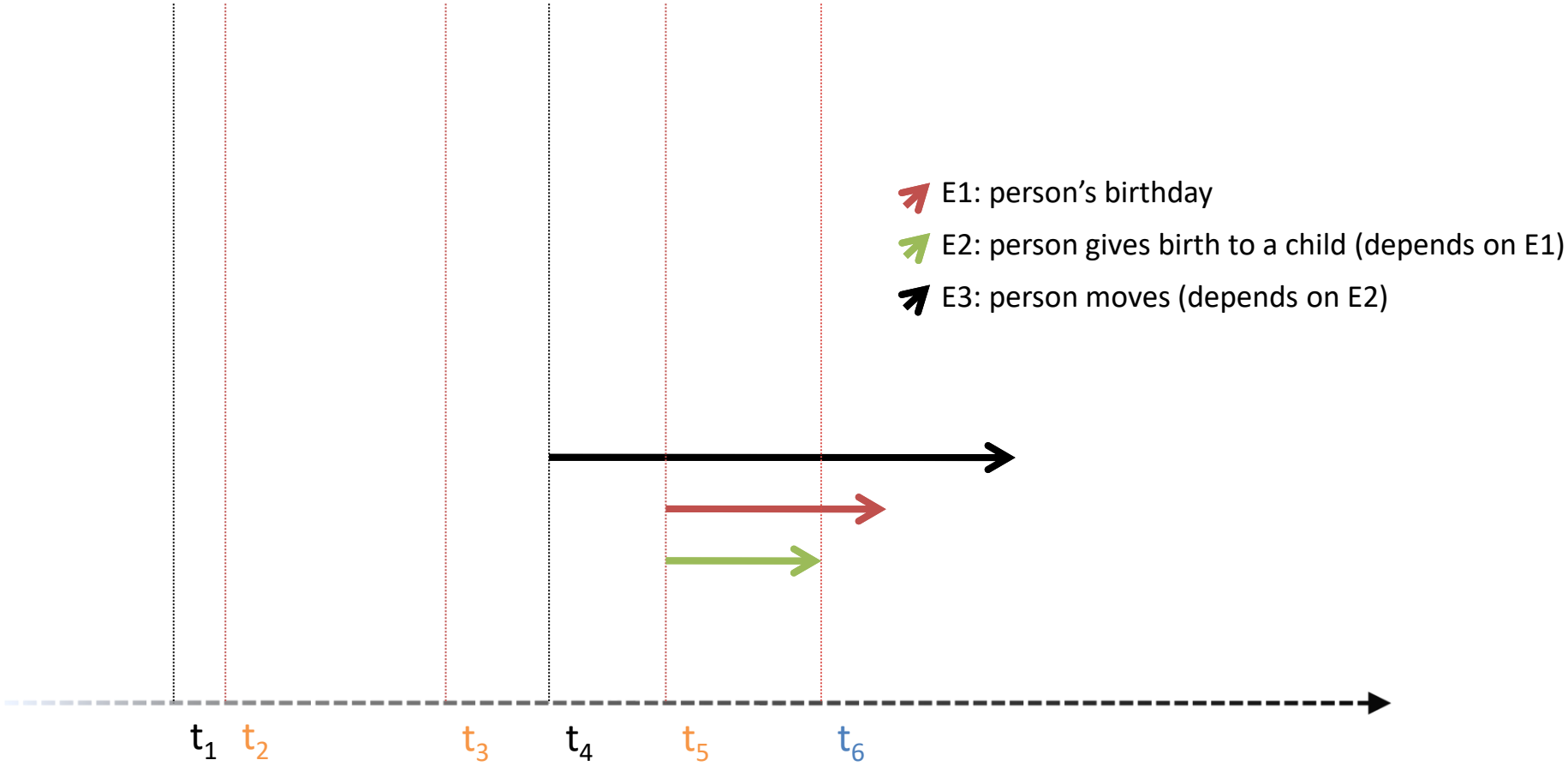

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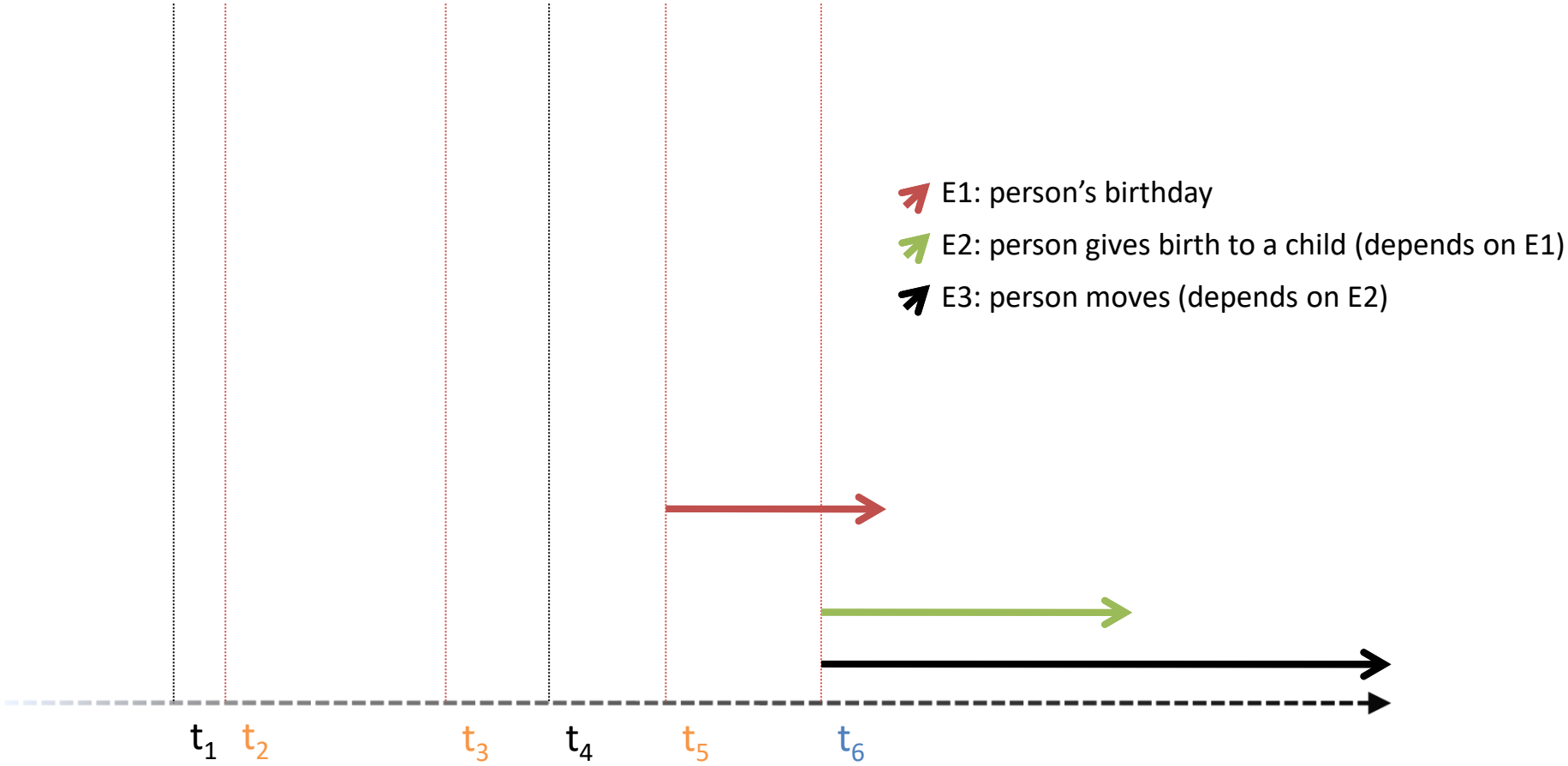
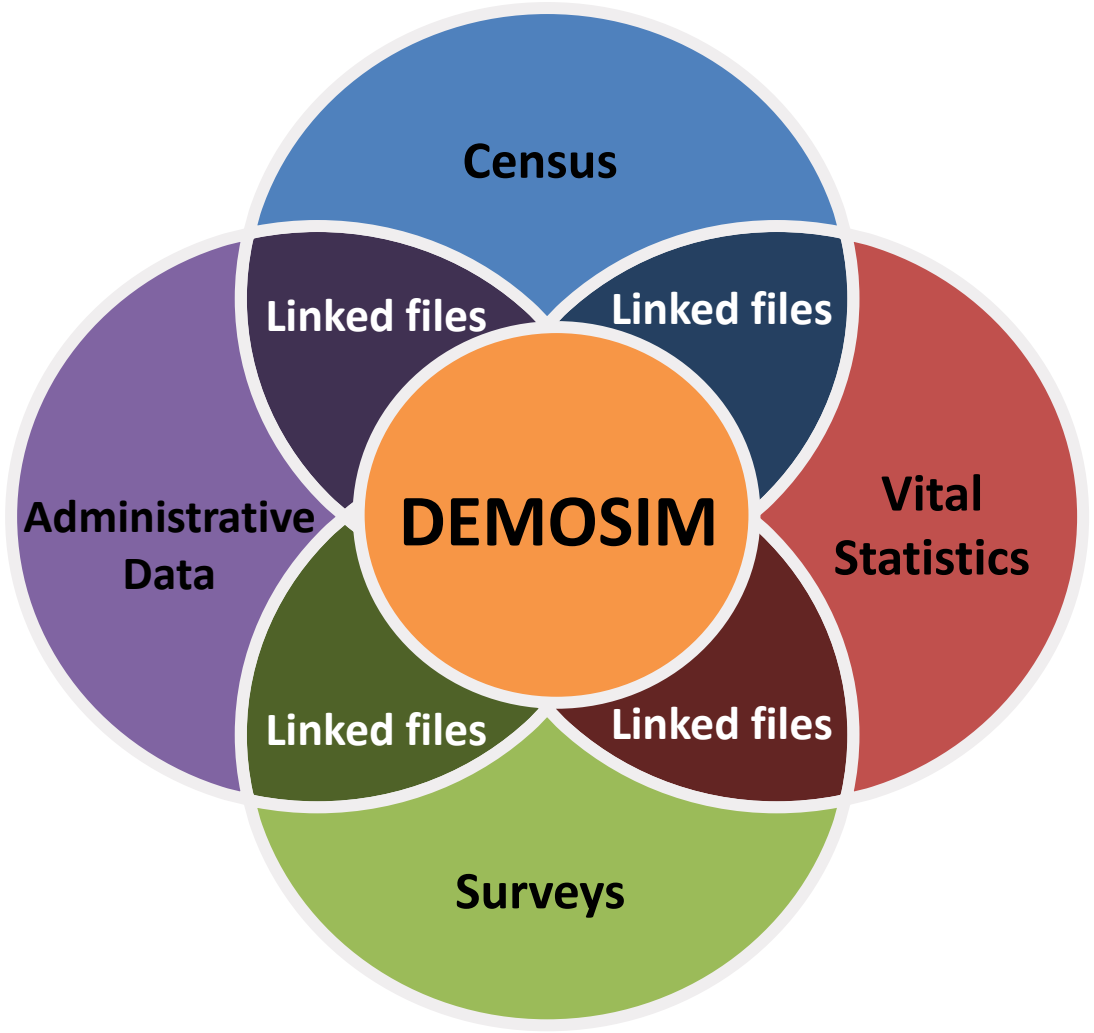


Events and Data Sources

- Fertility
- Mortality
- Immigration
- Emigration
- Internal migration
- Change of education level
- Marital status
- Language mobility
- Religious mobility
- Ethnic mobility
- Registration on the Indian Register
- Acquisition of Canadian citizenship
- Families and households
- Labour force participation



Fertility Module

Two-step method

1. Base risks: Fertility rates

   Age- Parity- Indigenous identity-specific

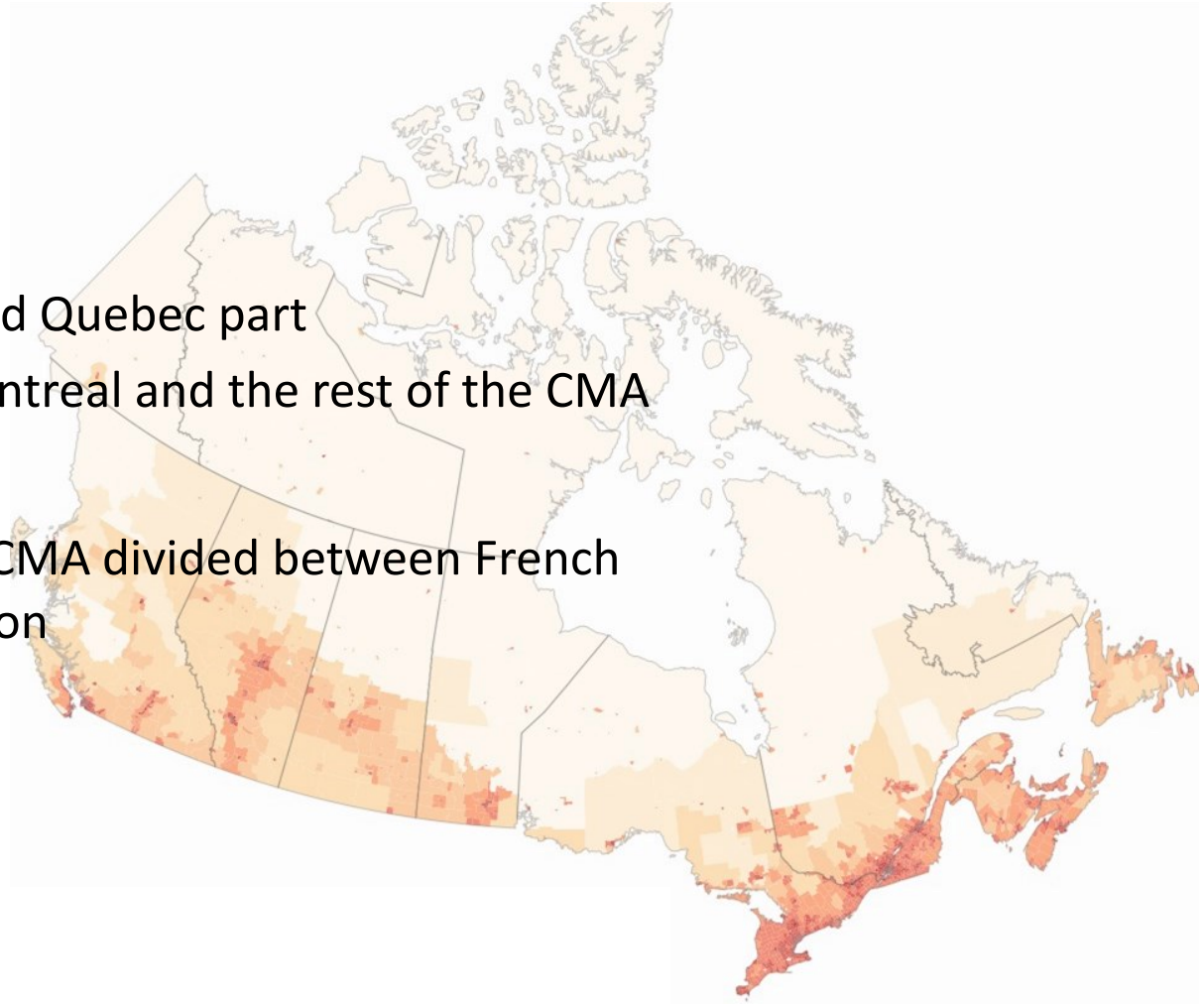
2. Relative risks: Adjustment of the probability of giving birth by many other characteristics

   Adjustment based on regression parameters accounting for women's region of residence, marital status, education level, racialized group, generation status, mother tongue, and religious affiliation

All modules are intertwined; most events depend on each other.

Geographic breakdown

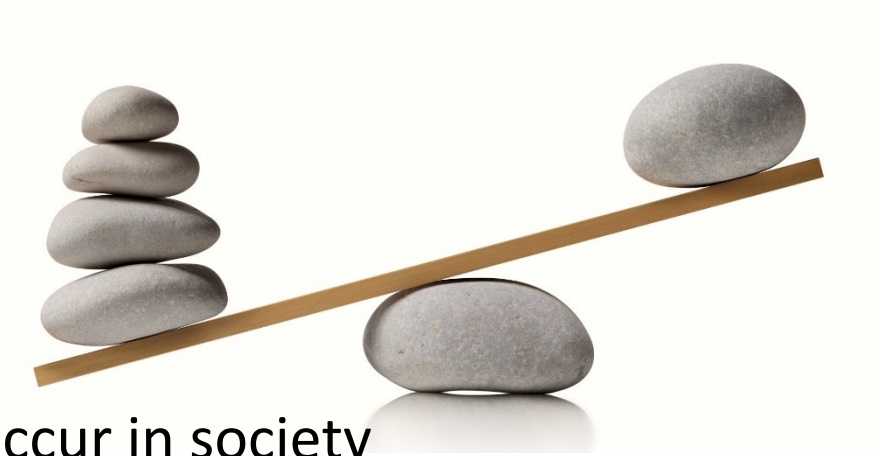
- **35 census metropolitan areas (CMA)**
  - Ottawa-Gatineau divided into its Ontario and Quebec part
  - Montreal divided between the island of Montreal and the rest of the CMA
- **Non-CMA parts of each province**
  - Ontario non-CMA and New Brunswick non-CMA divided between French concentration areas and the rest of the region
- **On/off Indian reserve, where it applies**
- **Inuit regions**



Policy analysis tool

- ✓ Demosim supports **decision making** and policy elaboration in various Canadian federal departments
- ✓ Policy makers are accustomed to thinking in terms of **scenarios** to evaluate the outcomes of different policies or to guide policy development
- ✓ Demosim provides the required **flexibility** to build tailor-made projection scenarios to address many research questions

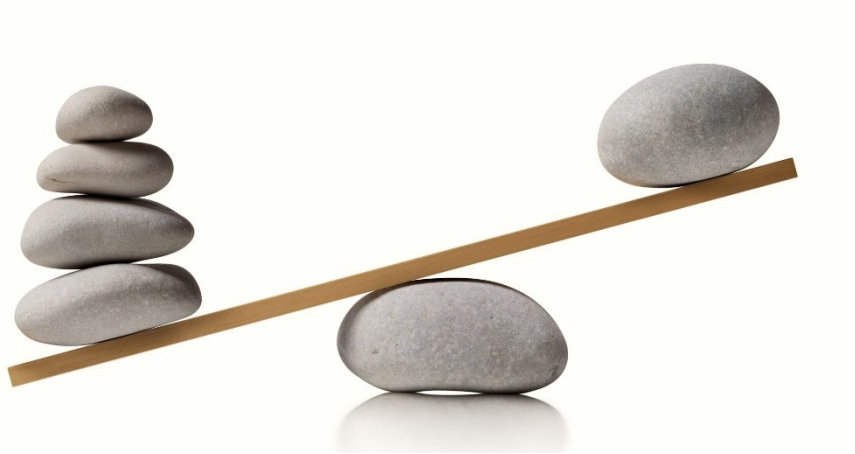
Strengths and challenges



- Demosim has the capacity to mimic changes that occur in society through the passage of time over generations, when subsequent cohorts differ from those that precede them

- Demosim is a powerful tool for developing policies, conducting research and answering complex questions
  - Education and labour force participation of Indigenous peoples
  - Immigration and languages in Canada
  - Ethnocultural diversification, population aging, and immigration

Strengths and challenges



- Requires high-quality data
- Costly
  - Development and maintenance are time consuming
  - Demanding in terms of human and computations resources
- Funding
- Recruitment
- Complex
  - Development must be planned long in advance
  - Lack of transparency

Upcoming developments

- Rebasing of Demosim based on the 2021 Census data
  - Building the base population
  - Determining the model's content, addition/removal of variables
  - Updating projection parameters

- Possible developments using variables included for the first time in the 2021 Census
  - Sex at birth and gender variables
  - Additional variables on Métis and Inuit self-identification

- Consultations with funding partners

Questions / Comments?

Thank you!

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