

HISTORISIERUNG

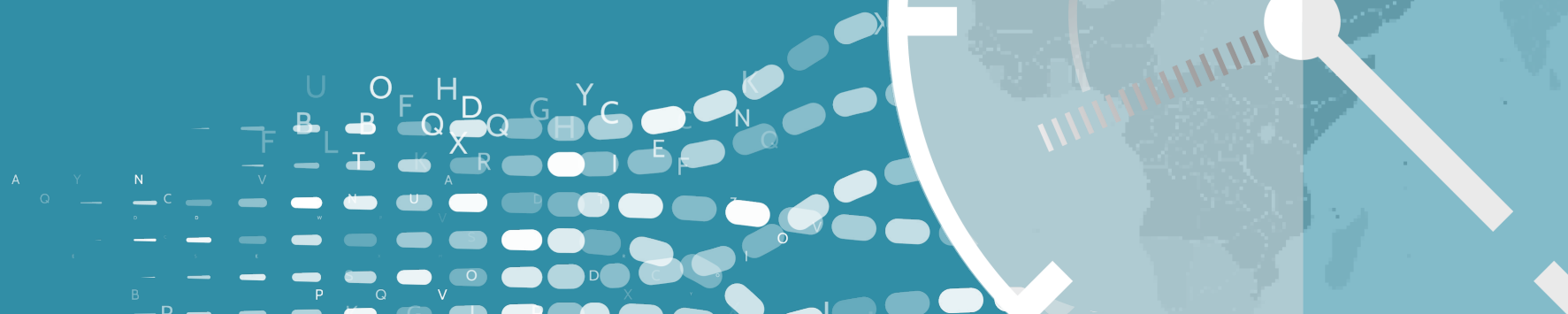
Grundlagen



**The Big Business Man smiled.
"Time," he said, "is what keeps
everything from happening at
once."**

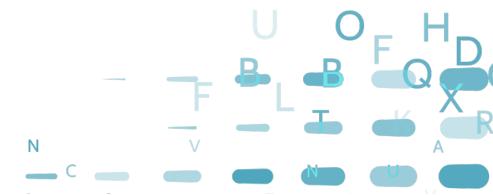
Ray Cummings, *The Girl in the
Golden Atom*, novel (1922)

BITEMPORAL TERMINOLOGY



TERMINOLOGY FOR BITEMPORAL DIMENSIONS

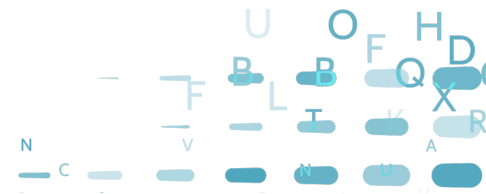
	„Business“	„Technical“
TSQL2 SQL Standard	Valid Time	Transaction Time
ISO SQL Standard	Application Time	System Time
IBM	Business Time	System Time
Asserted Versioning (2014)	State Time	Assertion Time
Data Vault	---	LDTs
Et cetera...		



TIMEZONE



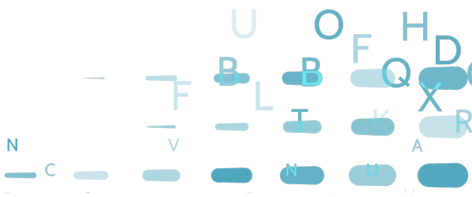
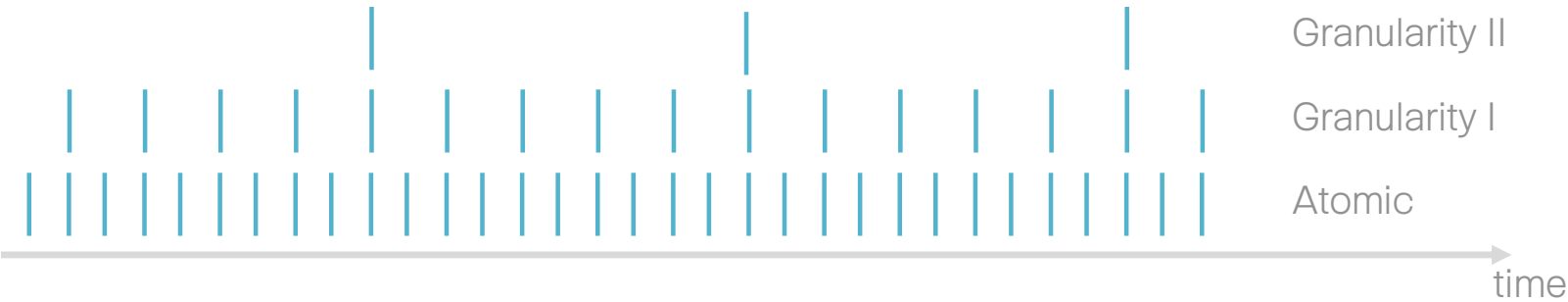
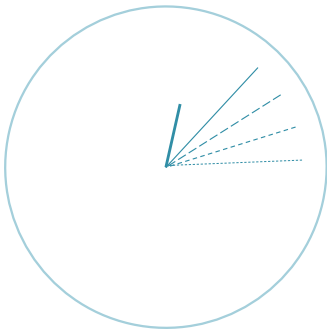
UTC
OR
UTC + LOCAL TIME



CLOCK TICK & TIME PERIODS

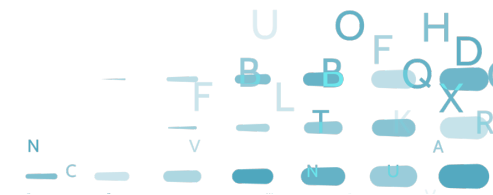


CLOCK TICK



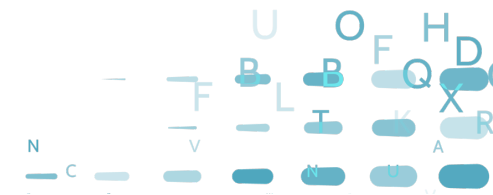
TIME PERIOD – DE FACTO STANDARD

- Closed / Closed
 - Closed / Open
 - Open / Closed
 - Open / Open
- T_1 [Jan16 - Dec16] ; T_2 [Jan17 - Dec17]
 - T_1 [Jan16 - Jan17[; T_2 [Jan17 - Jan18[
 - T_1]Dec15 - Dec16] ; T_2]Dec16 - Dec17]
 - T_1]Dec15 - Jan17[; T_2]Dec16 - Jan18[



TIME PERIOD – DE FACTO STANDARD

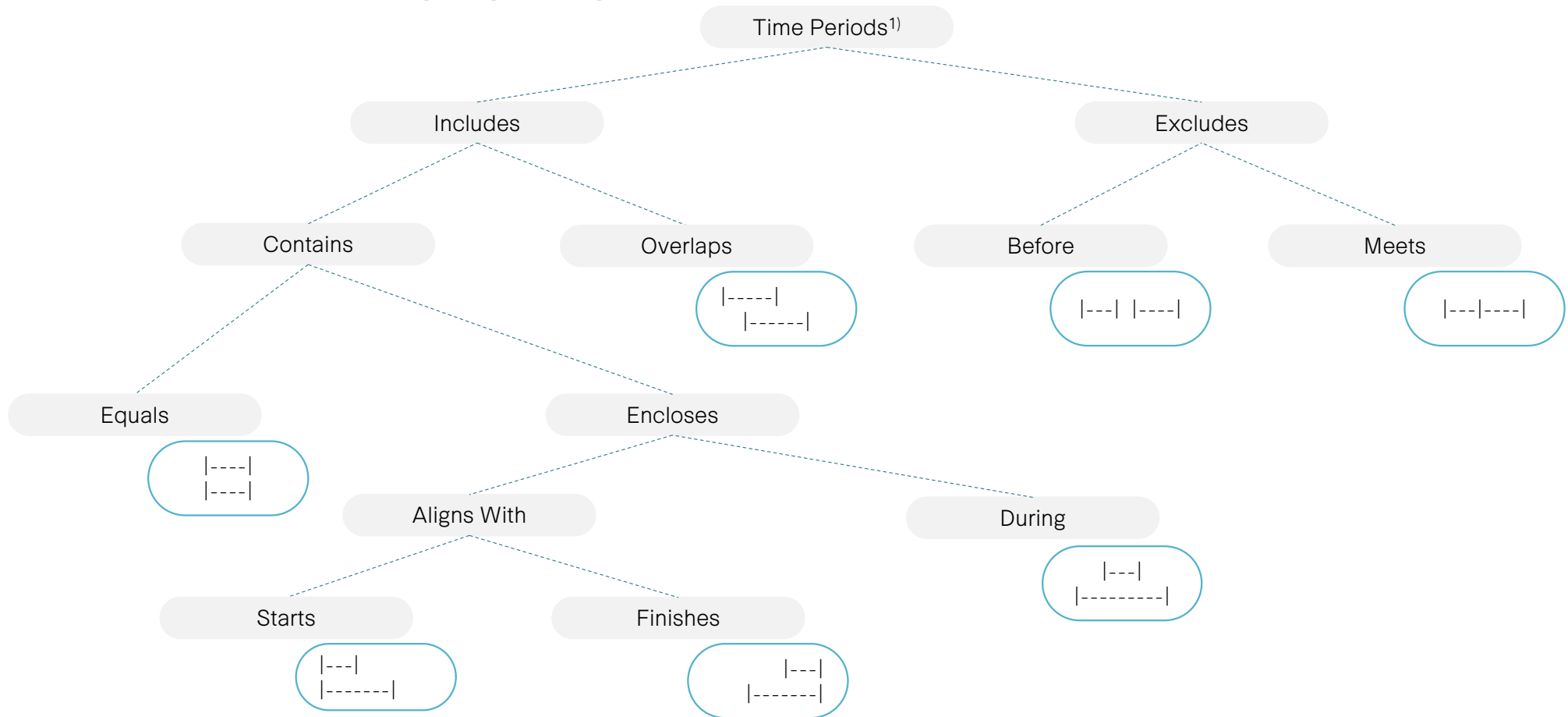
- Closed / Open
 - T_1 [Jan16 - Jan17[; T_2 [Jan17 - Jan18[
-
- **No** Clock Ticks between Time Periods
 - **No** need to know anything about Clock Ticks
 - Window-Function Lead() / Lag() **possible**
 - **Less** effort for merging satellites
 - **De facto standard**, also in ISO 9075:2011 and TSQL2



ALLEN RELATIONSHIP



THE ALLEN RELATIONSHIPS



TEMPORAL DATA OUT OF SOURCE SYSTEM

Meets*

|---|----|

[Mar17 , Dec17[* | A01 | Dirk | Bachelor | 201

[Jun16 , Mar17[* | A01 | Dirk | Bachelor | 101

```
[Meets                                     ]
[                                     |--1--| ]
[          |--2--|                      ]
```

TEMPORAL DATA OUT OF SOURCE SYSTEM

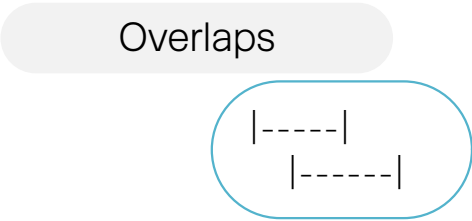
Meets*

|---|----|

[Mar17 , Dec17[* | A01 | Dirk | Bachelor | 101
[Dec17 , May18[* | A01 | Dirk | Bachelor | 201

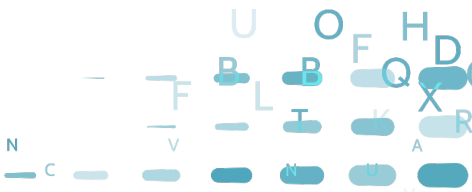
```
[Meets                                     ]
[           |--1--|                       ]
[                               |--3--|    ]
```

TEMPORAL DATA OUT OF SOURCE SYSTEM

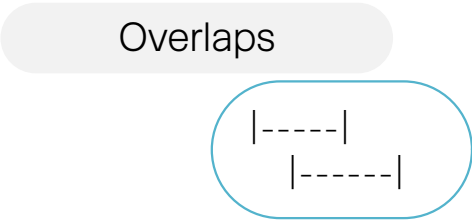


[Jun16 , Mar17[| A01 | Dirk | Bachelor | 101
[Feb17, Dec17[| A01 | Dirk | Bachelor | 201

[Overlaps
[| --1-- |
[| --2-- |]

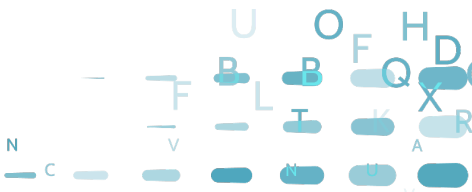


TEMPORAL DATA OUT OF SOURCE SYSTEM



[Jun16 , Mar17[| A01 | Dirk | Bachelor | 101
[Feb16, Oct16[| A01 | Dirk | Bachelor | 201

[Overlaps
[| --1-- |
[| --3-- |]

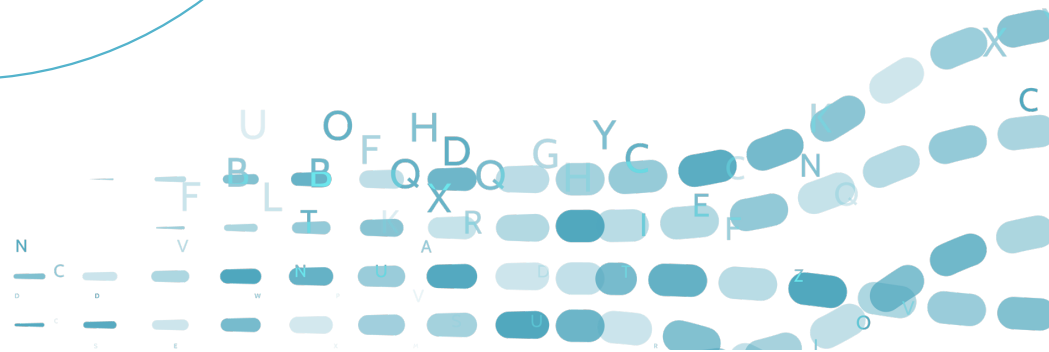


BITEMPORAL BUSINESS NEEDS



DATA AND TIME

What did you know?
- And -
when did you know it?



BUSINESS NEEDS

When data occasionally arrives out of order

Store reality in past, present and future

Make corrections against the past

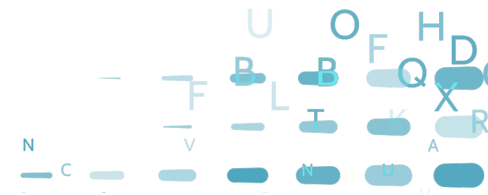
Ability to query through time

Retroactive Operations

Decision analyses

Legal regulations

Auditing



LATE ARRIVAL OF DATA



Inscribe changes of contact e-mails - **but some have a late arrival**

Non-temporal data model

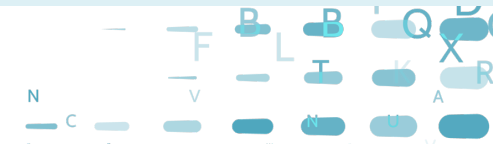
- Data arriving late overwrites the current data with outdated information.

Uni-temporal data model

- Late arrivals of data with outdated information are considered current.
- The current data is historized and is erroneously considered out of date.

Bi-temporal data model

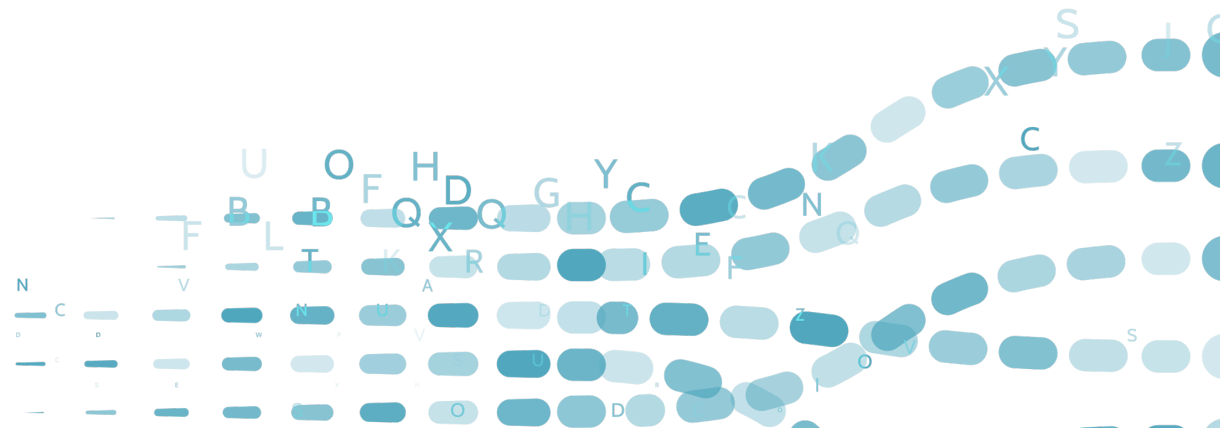
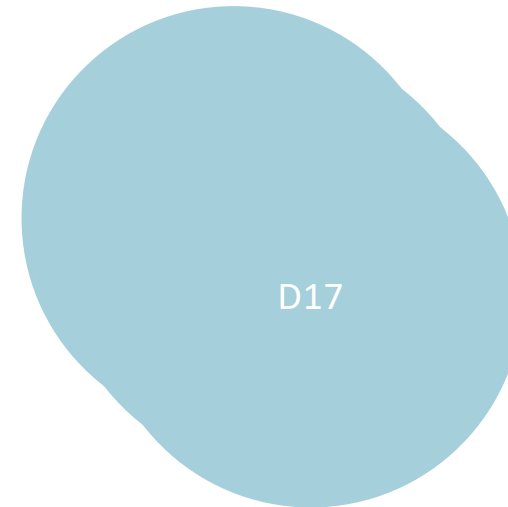
- Late arrivals with outdated information are correctly historicized on the timeline.
- Updating the previous historicized data to the now correct data.
- Confidence in changes



CURRENT DATABASE

Contact e-mails changes

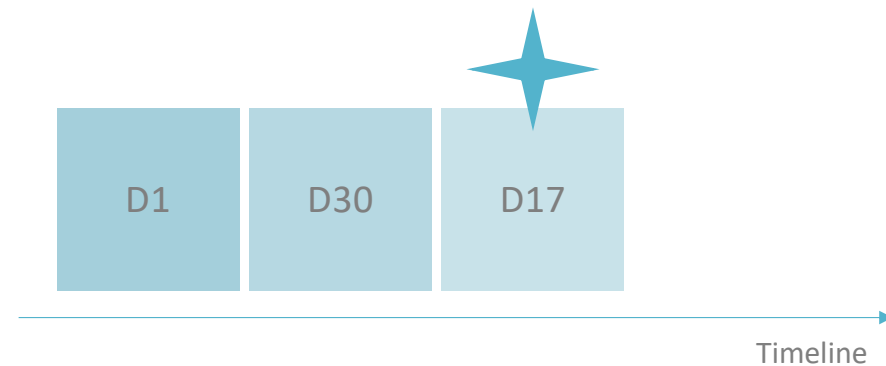
- (D1) -> Dirk@DataVaultModeling.de
- (D30) -> Dirk.Lerner@tedamoh.com
- **Late arrival:**
(D17) -> Dirk.Lerner@tedamoh.de (on D55)



UNI-TEMPORAL DATABASE

Contact e-mails changes

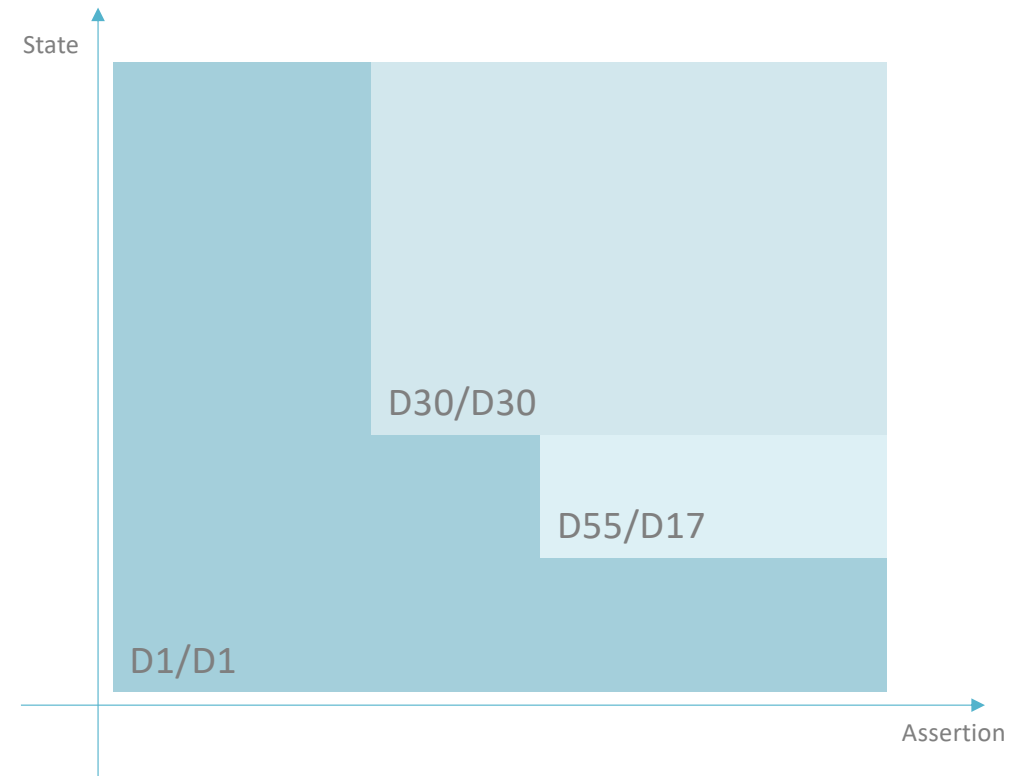
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BI-TEMPORAL DATABASE

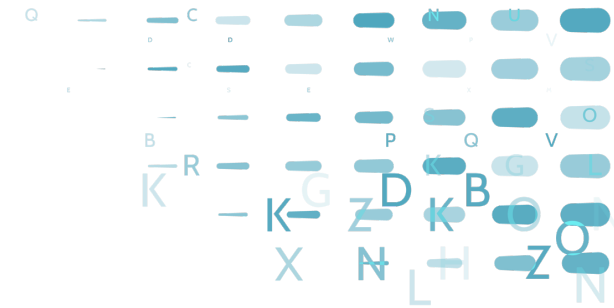
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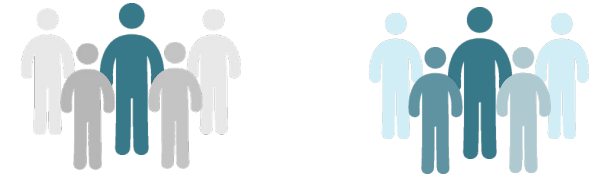
PROBABILITY OF A DATA ERROR

- Wrong
 - information delivered by a data vendor
 - files reported by external Supplier (e.g. custodian)
- Errors made by
 - people maintaining data
 - machines, automation and robotics (abort, restart – e.g. POS system)



PROBABILITY OF A DATA ERROR

Make corrections against the **past**



Non-temporal data model

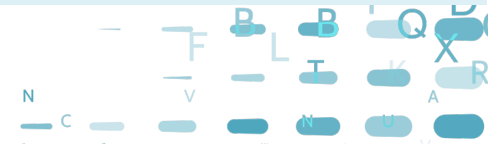
- which past?

Uni-temporal data model

- rewrite old data
- As-Of (aka Then/Then) is not possible

Bi-temporal data model

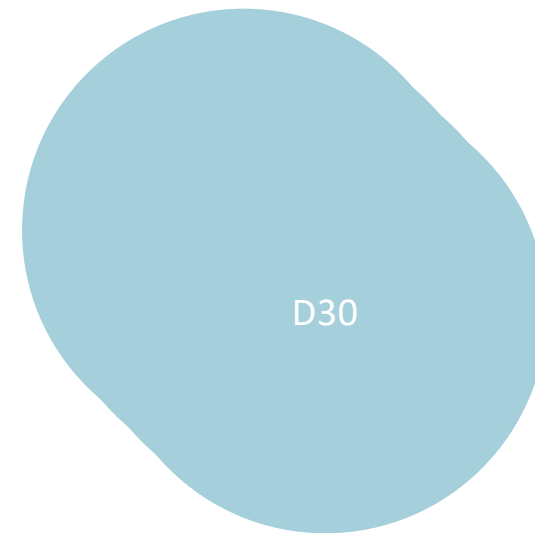
- Make corrections
- keep errors



CURRENT DATABASE

Contact e-mails changes

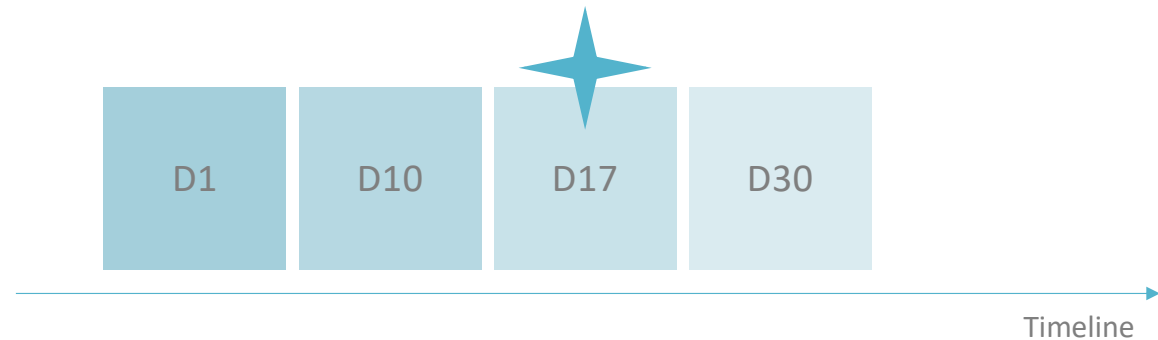
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UNI-TEMPORAL DATABASE

Contact e-mails changes

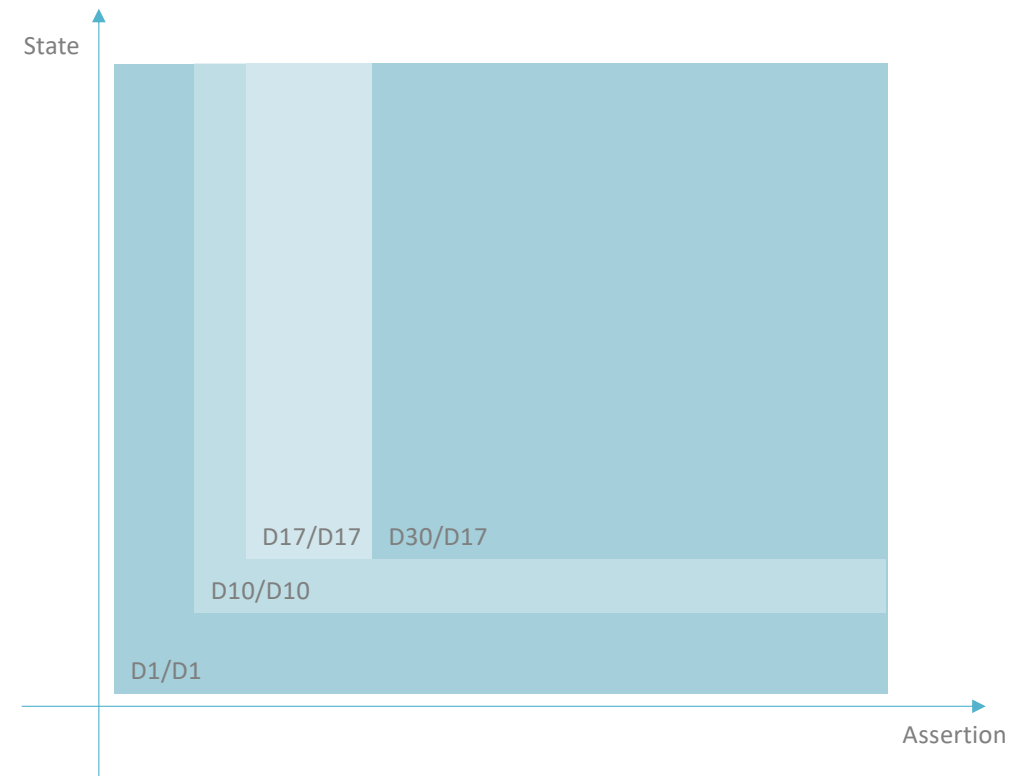
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BI-TEMPORAL DATABASE

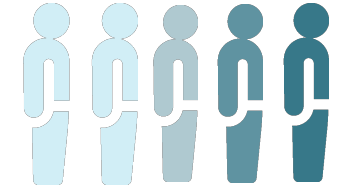
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FEDERAL REGULATIONS

Store transactional data **non-rewriteable and non-erasable**



Non-temporal data model

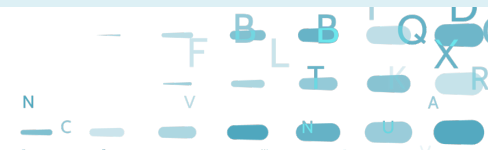
- rewrite old data

Uni-temporal data model

- history by a single time-axis (transaction or business)
- As-Of (aka Then/Then) is not possible

Bi-temporal data model

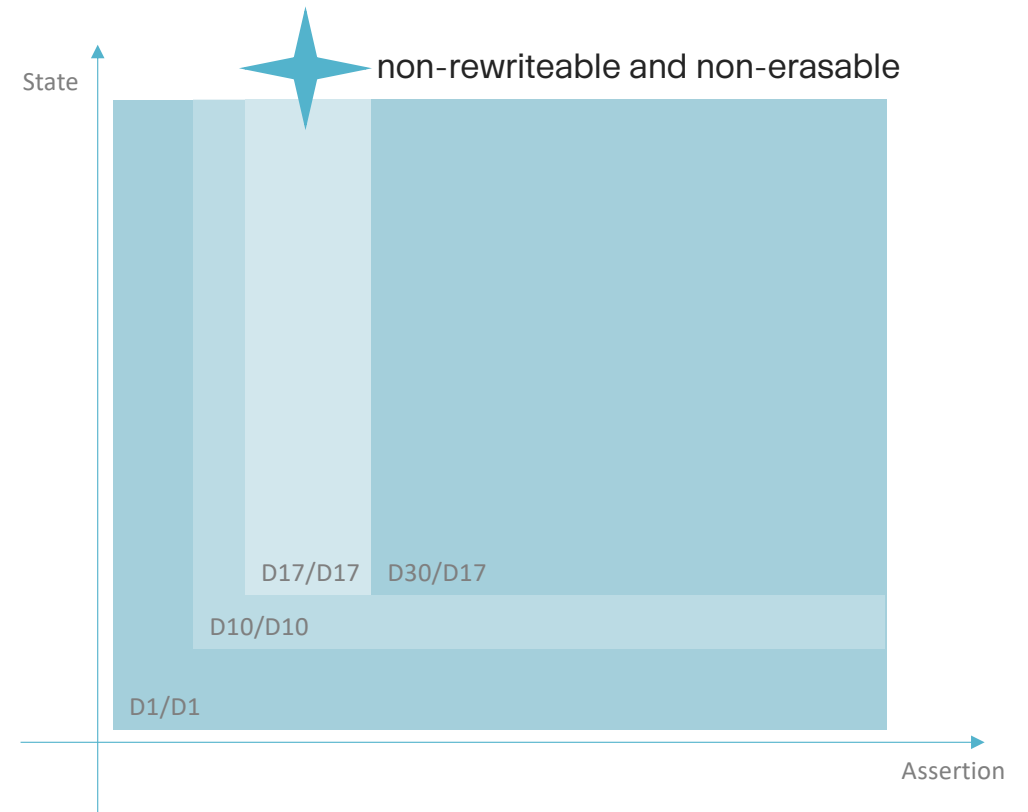
- Audit access
- Traceable data
- Confidence in changes



BI-TEMPORAL DATABASE

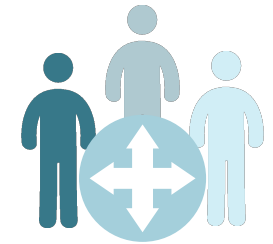
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DECISION ANALYSIS

Forest Fire in Australia - Decision Analysis Rescue Services



Non-temporal data model

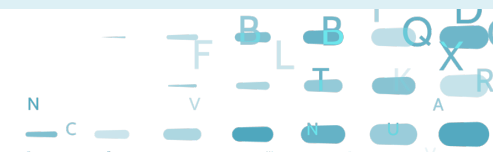
- Gradually, incoming data overwrites the current data with new findings.

Uni-temporal data model

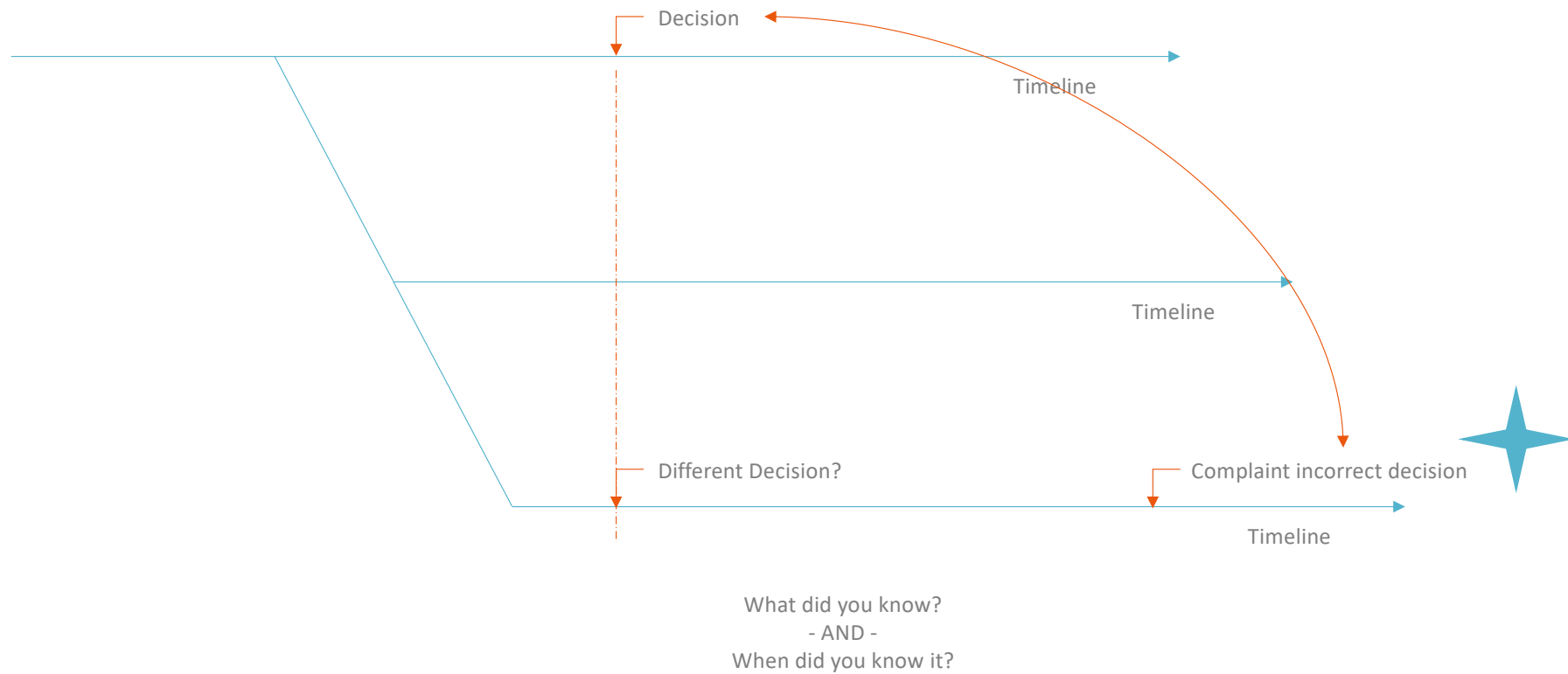
- Gradually, incoming data replace the current data with new findings.
- BUT: without the correct time context!

Bi-temporal data model

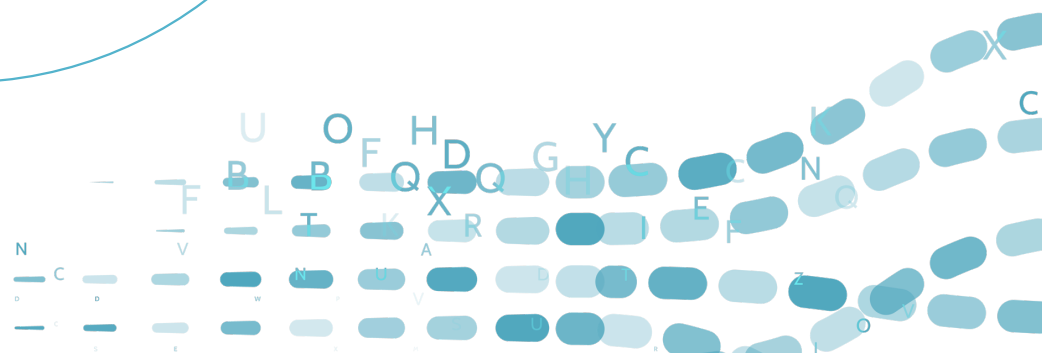
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DECISION ANALYSIS



Confidence in Changes!

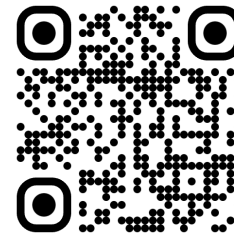


THE BOOK

Data is evidence on past activity, events that are frozen in time for us to uncover and analyze. Without understanding the context of how it is created, data is simply 'stuff'.

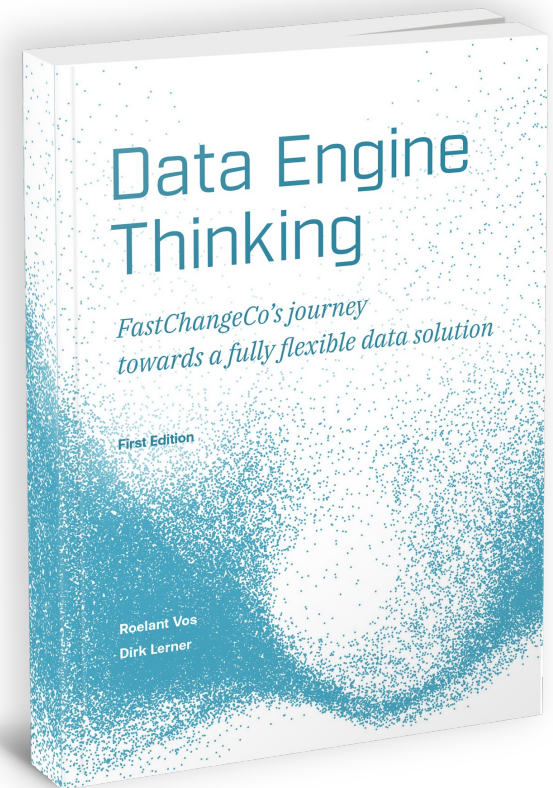
Data Engine Thinking covers the end-to-end methodology to deliver a data solution that is truly designed to adapt to progressive understanding - and ultimately meet the business' needs.

- Design and implement a solution that is designed for change
- Solve real-world problems encountered when working with data
- Fully automate your delivery



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eBook: <https://dtng.link/amz-eb>



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