Universität Hamburg
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Christian Burkert, Hannes Federrath

Towards Minimising Timestamp Usage in Application Software

A Case Study of the Mattermost Application

26.09.2019

Project: Employee Privacy in Development and Operations

EMPRI-DEVOPS

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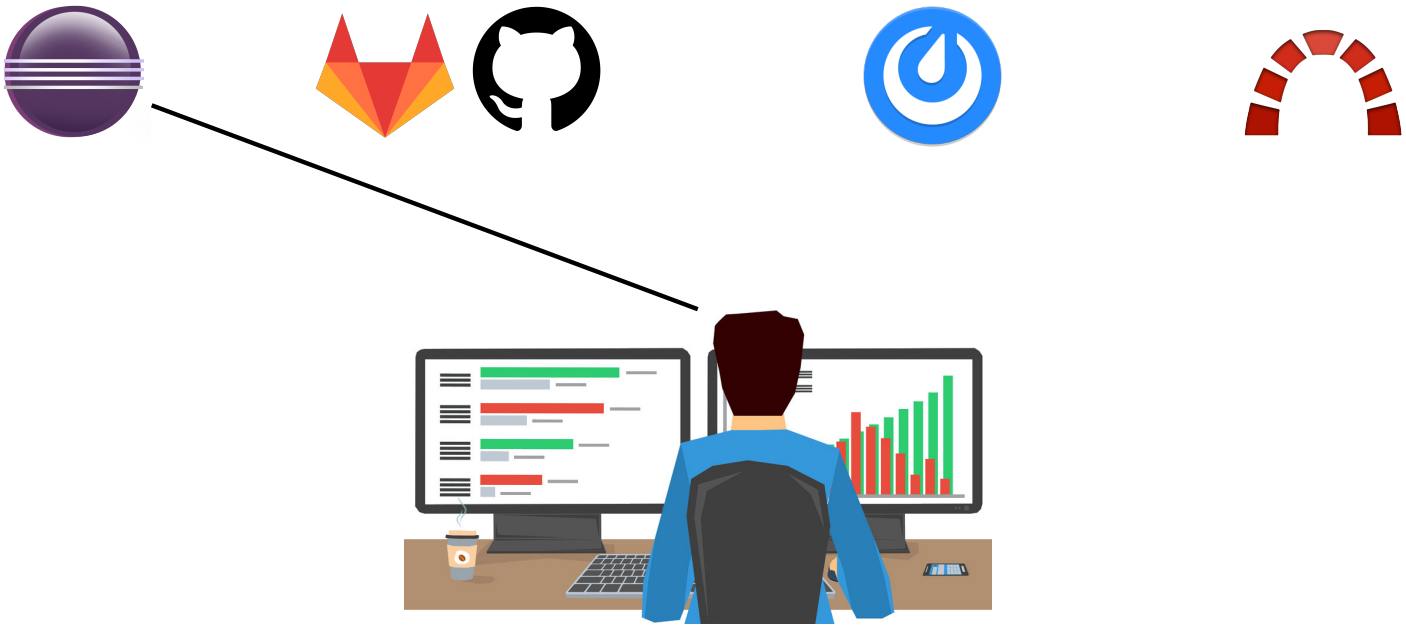

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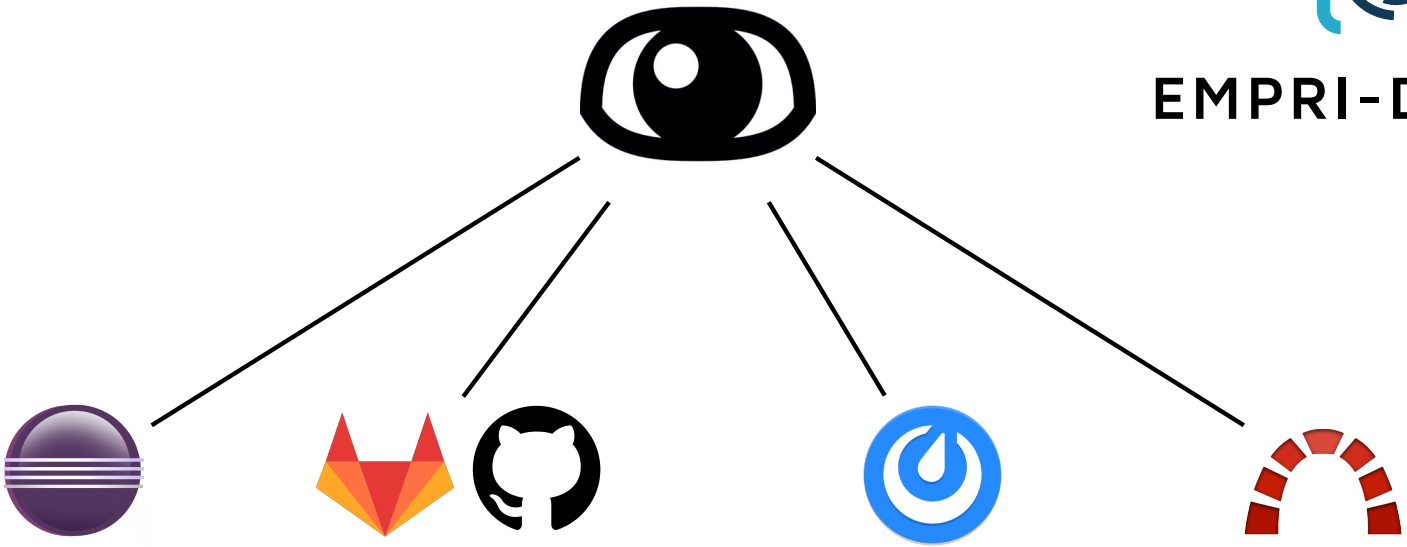
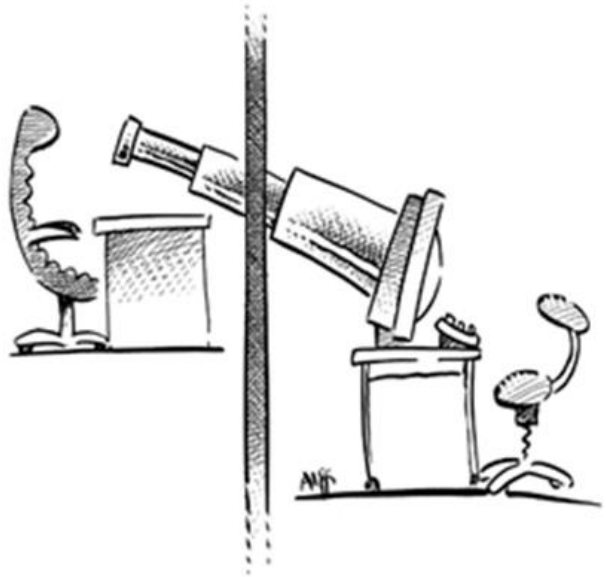


EMPRI-DEVOPS

Monitoring of Employees



Source: Unabhängiges Landeszentrum für Datenschutz Schleswig-Holstein (ULD)

Monitoring of Employees

Monitoring

- Performance
  Down on Mondays?
- Progress
  Stuck on a task?
- Habits
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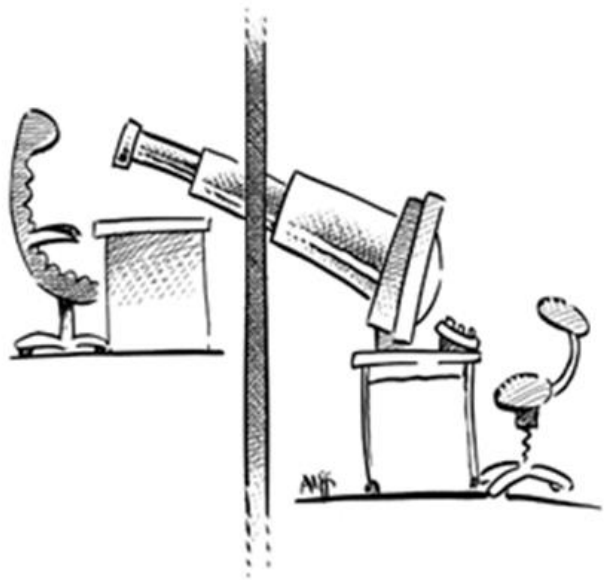

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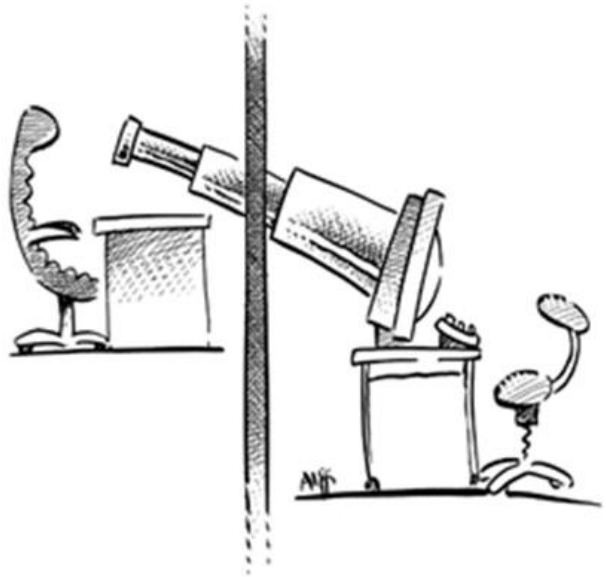
Employment

- Power imbalance
  Collective measures vs. individual consent



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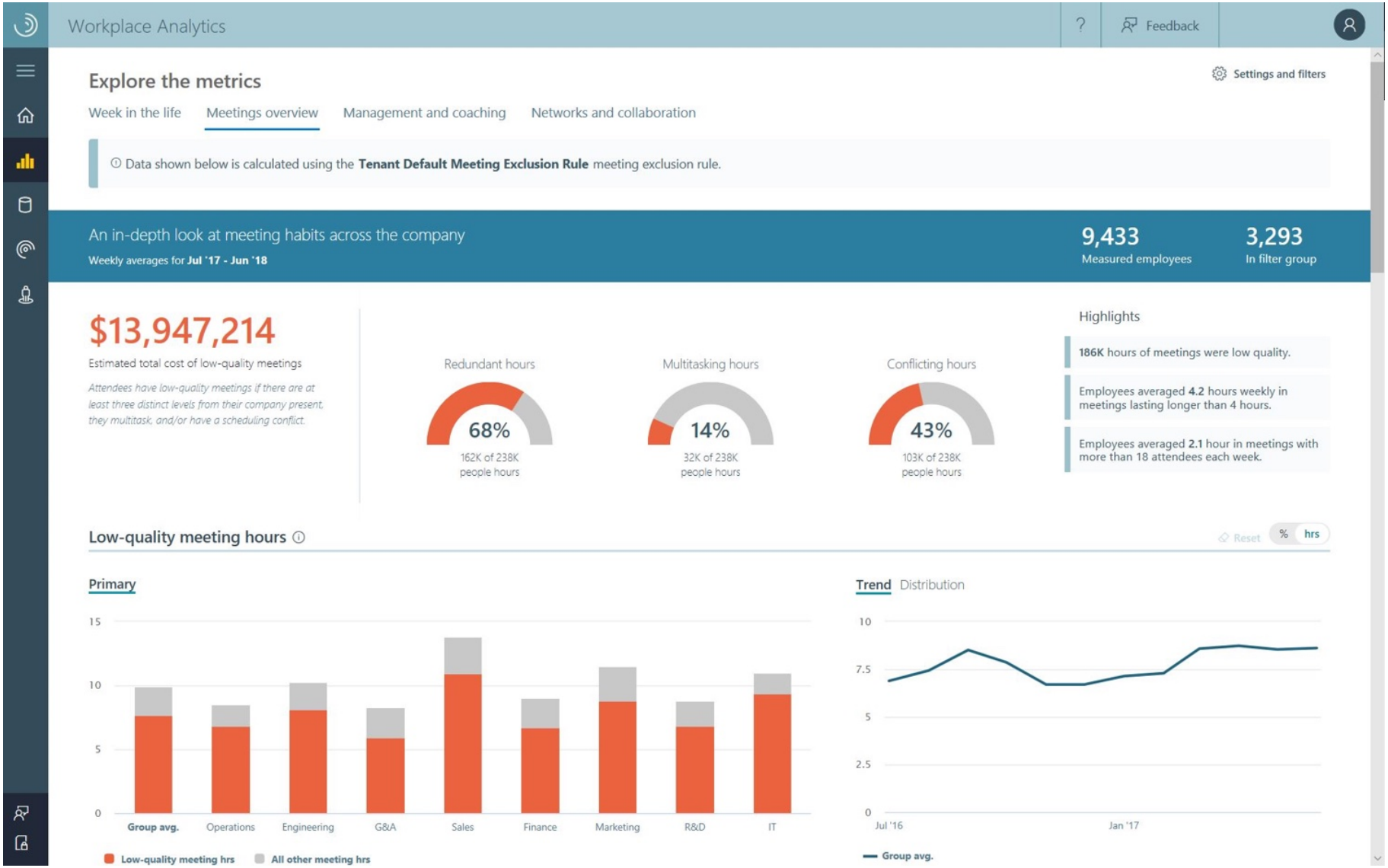
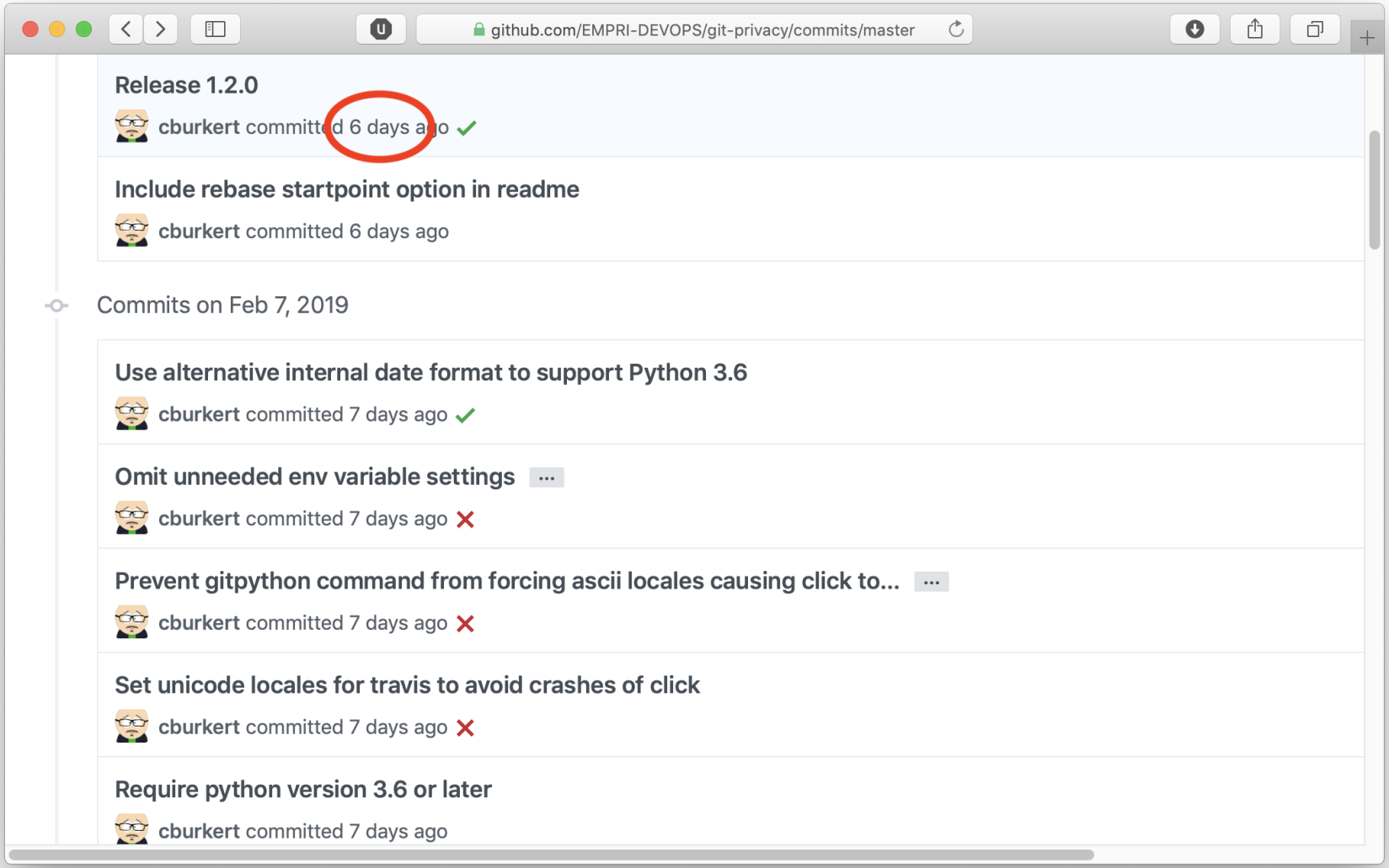
People Analytics: Microsoft Workplace Analytics



People Analytics: IBM Personal Social Dashboard

Timestamp Metadata



Timestamp Metadata: Research Questions

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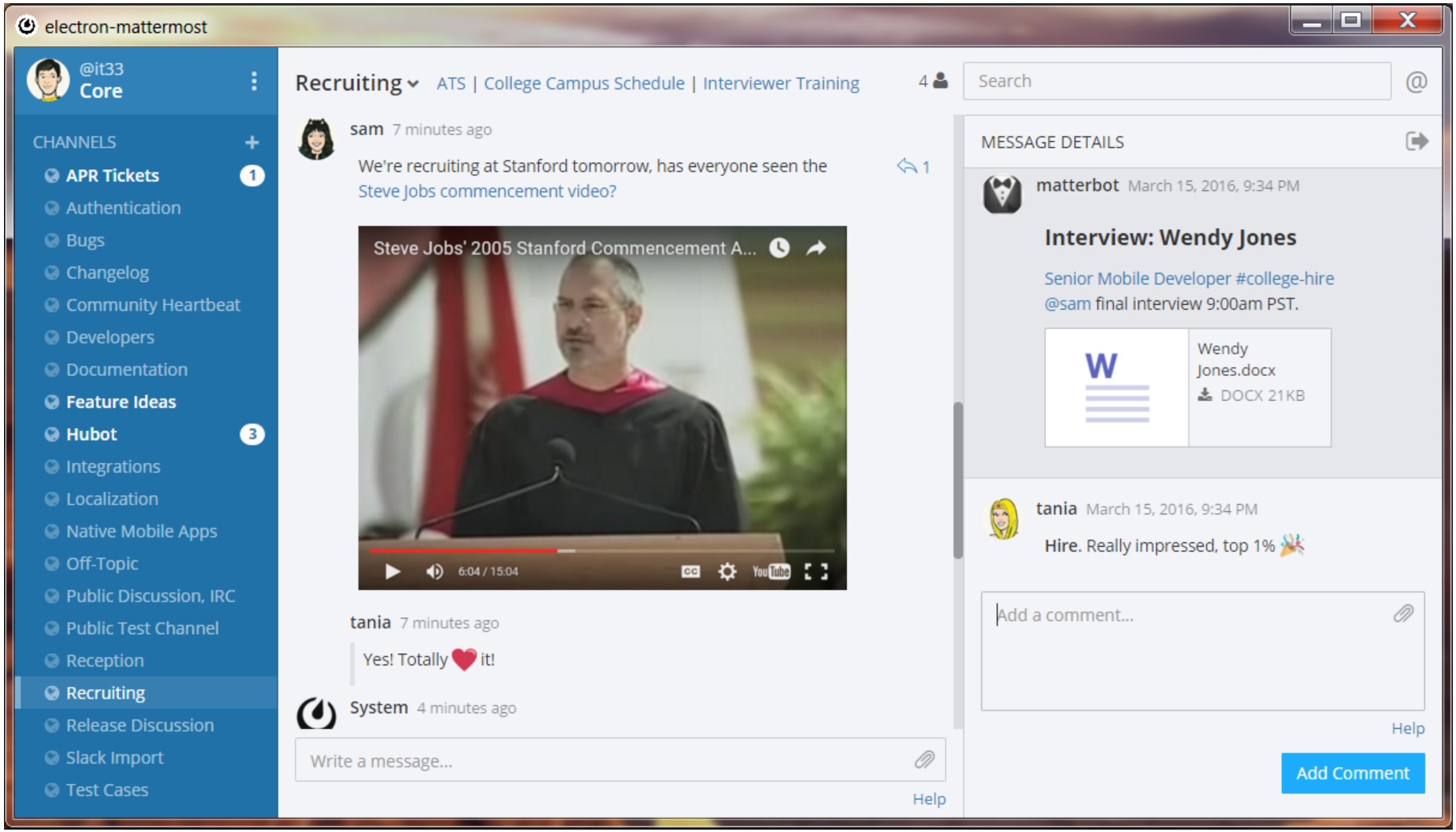
Case Study: Mattermost



Source: mattermost.com

Purpose Analysis: Methodology

RQ1 Where do timestamps occur in the data model?

1. Find all uses of `int64` keyword in model code
2. Filter out non-timestamp related occurrences

Target of evaluation:
Mattermost Server v4.8, Mattermost Web Client v5.5.1

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RQ3 For what purpose are they collected/processed?

4. Locate all uses of these timestamps with `gorename`
5. Inspect source code of all uses and categorise them
6. Discard all non-programmatic uses
   (i.e., which have no effect on MM's behaviour)
7. Identify user facing timestamps by in the web client

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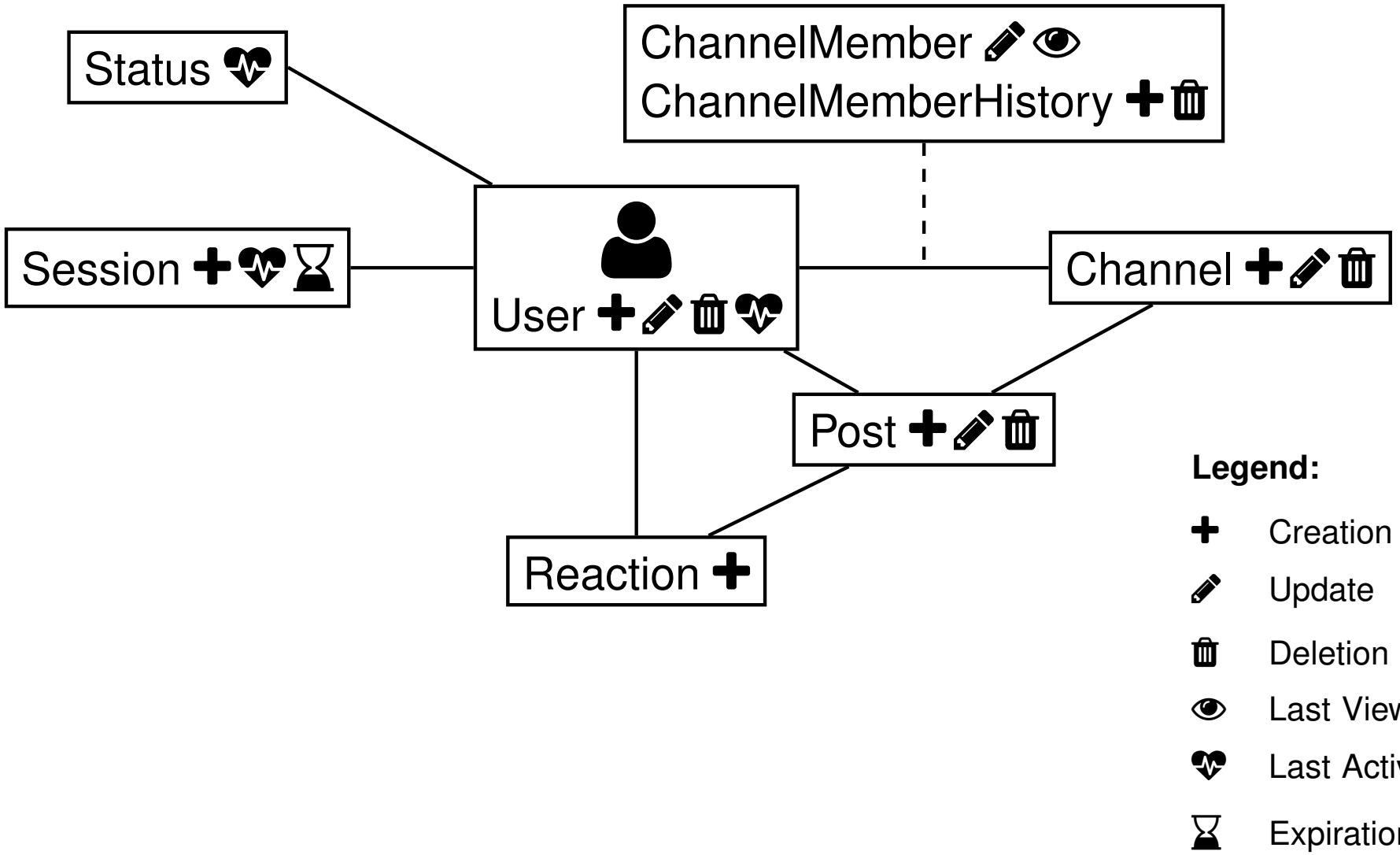
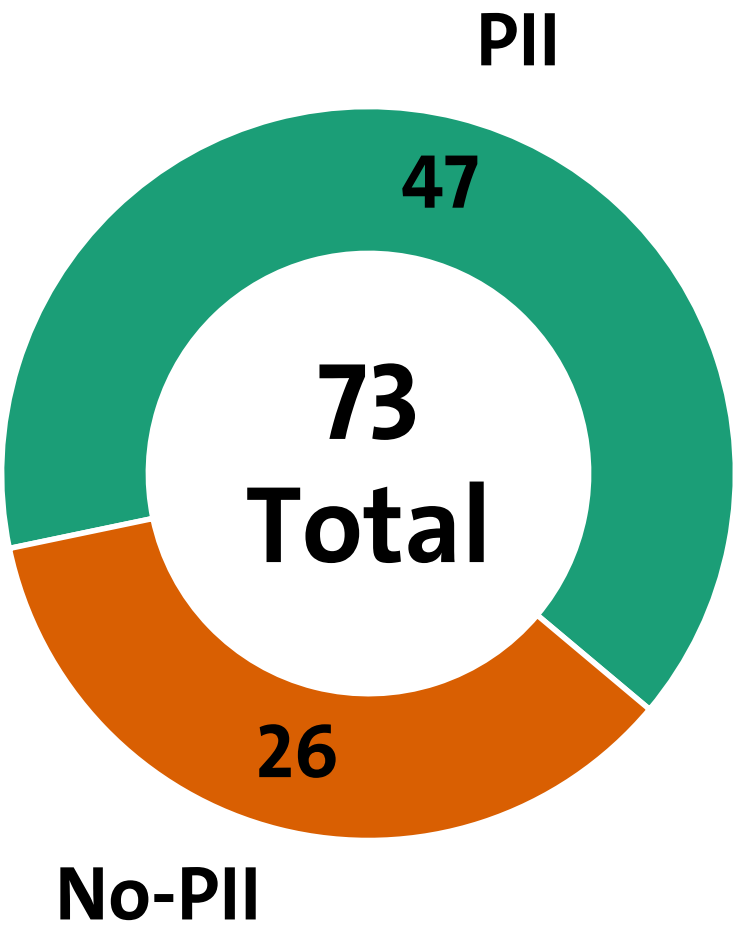
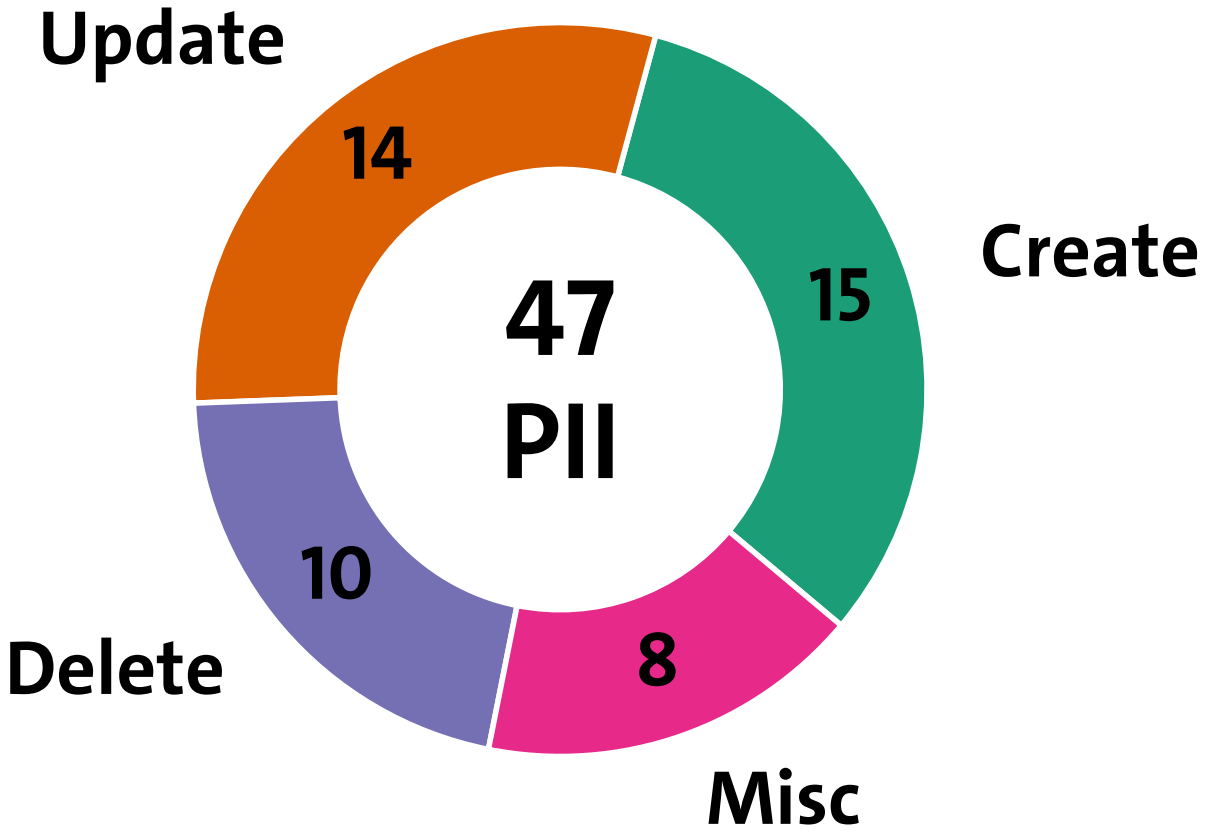
Timestamps in Mattermost's Data Model (Excerpt)



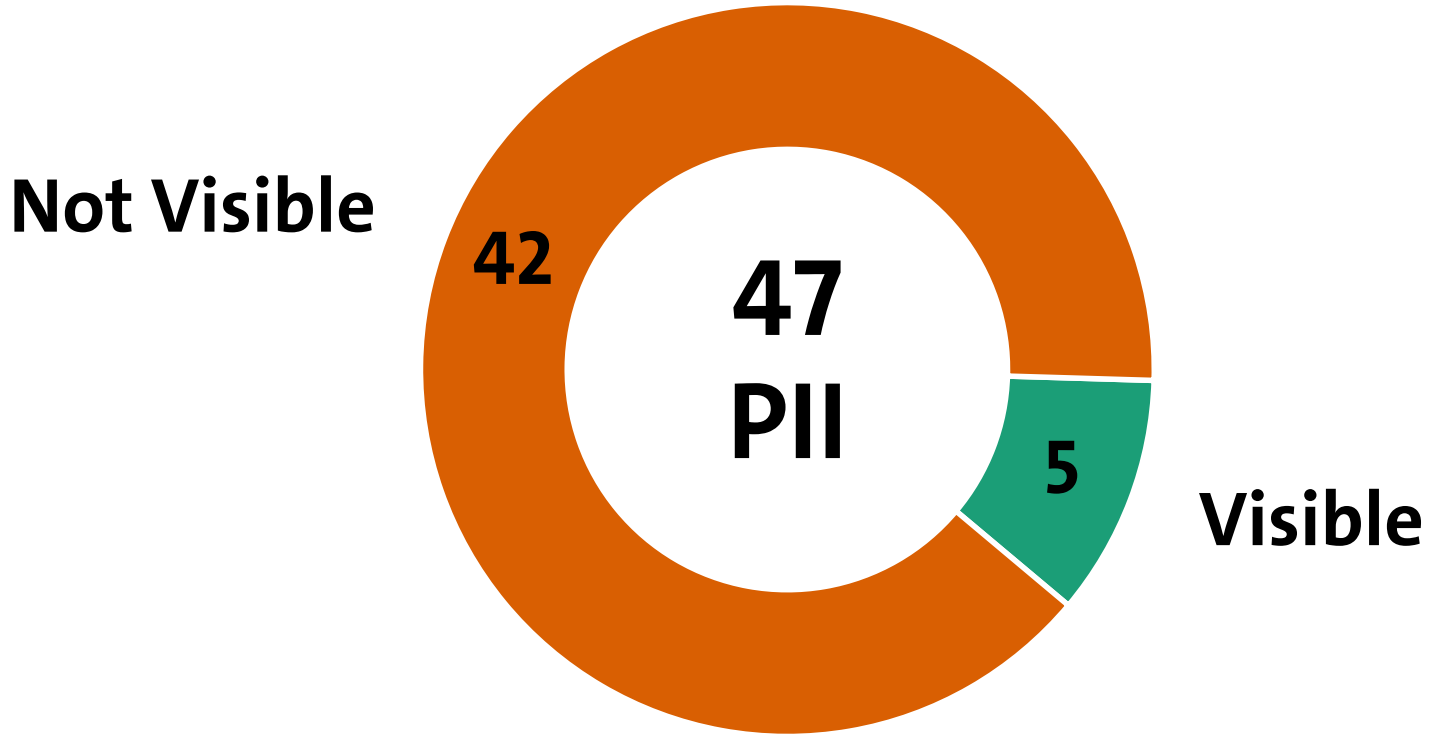
PII vs. Non-PII Timestamps



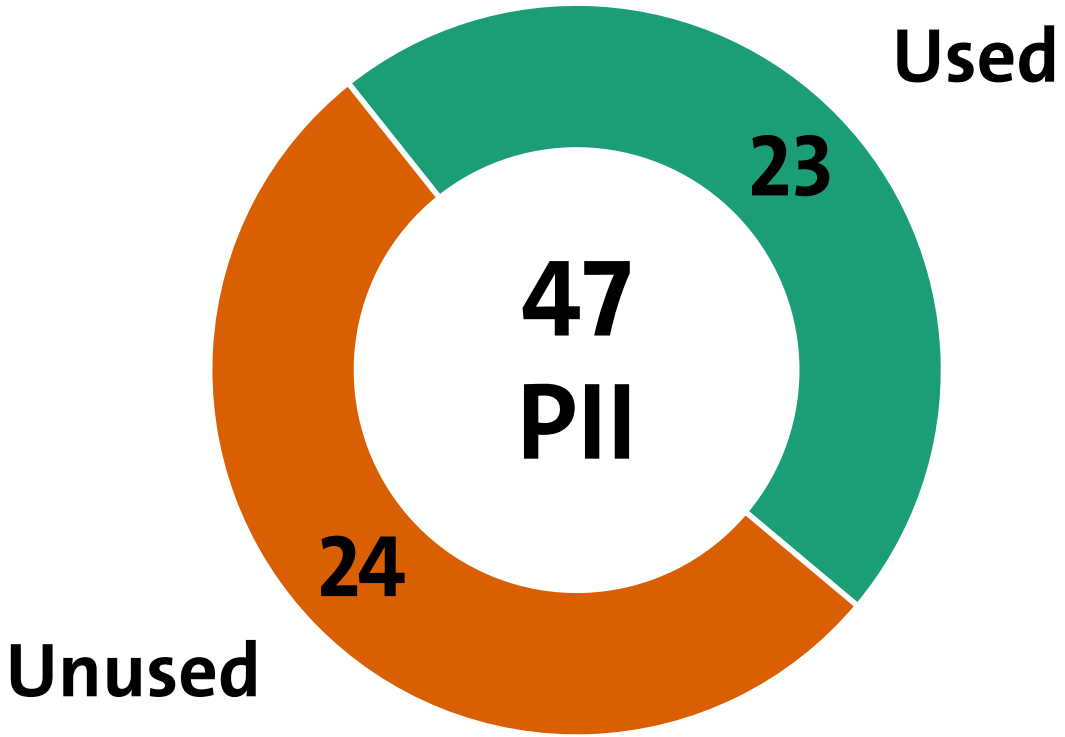
Timestamp Types



Visibility for Users



Programmatic Usage

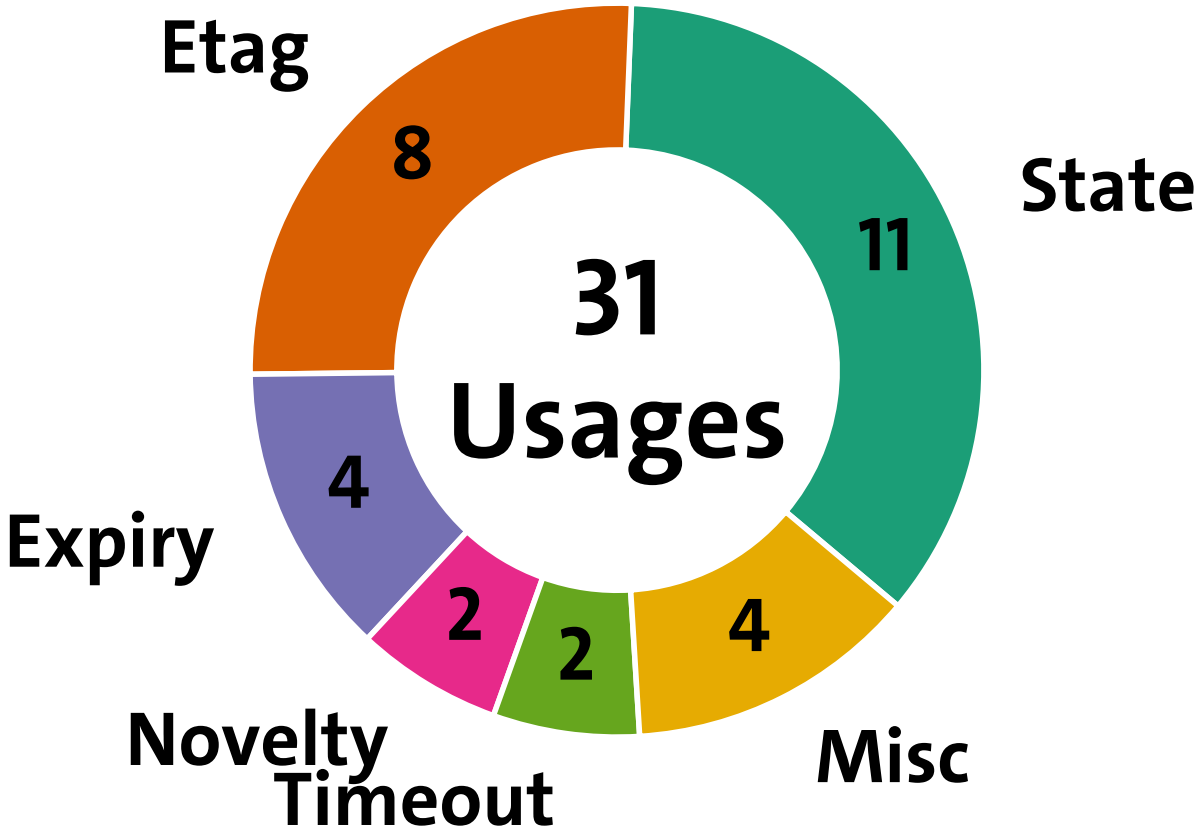


Distribution of Types between Used and Unused

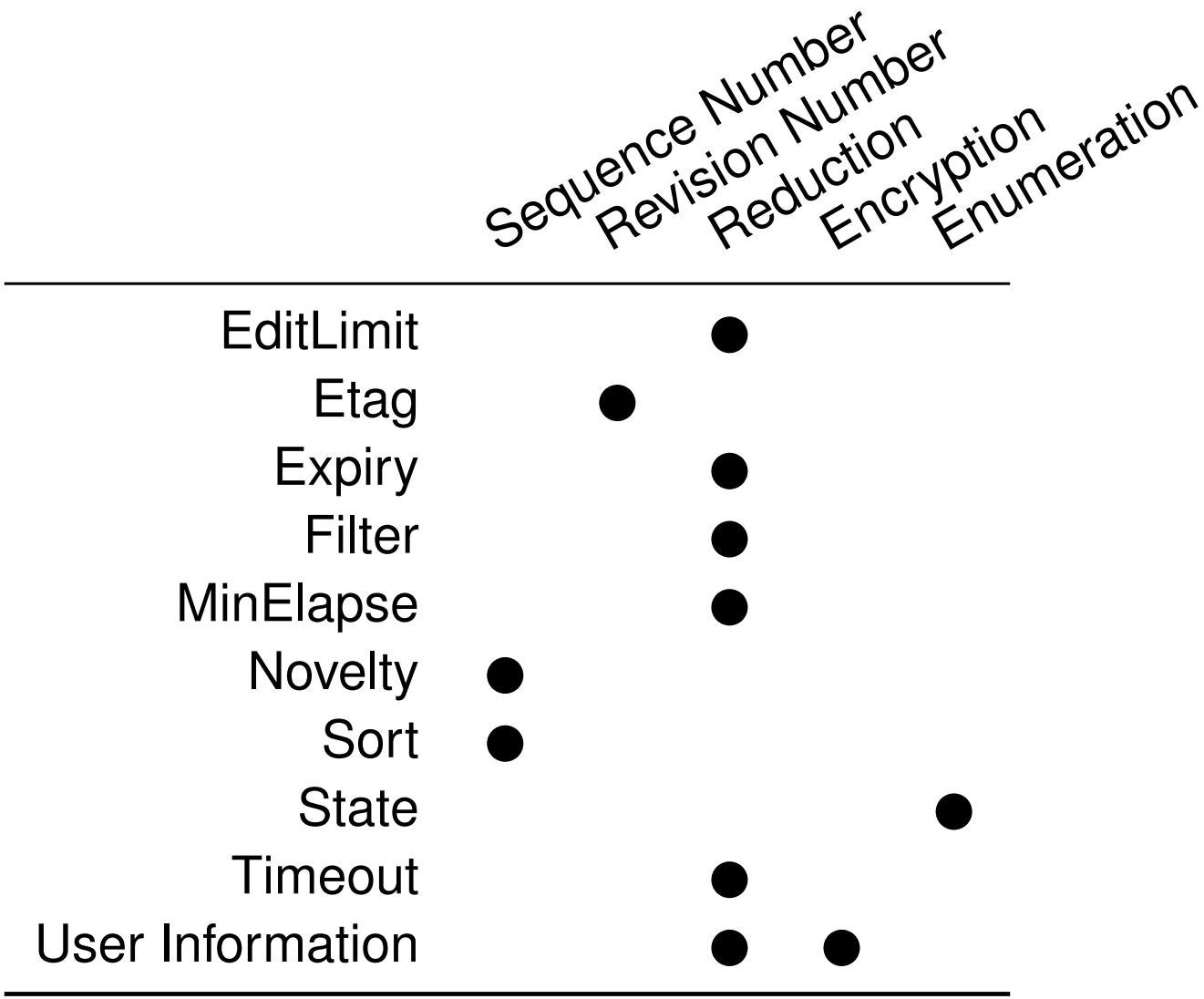
Categories of Programmatic Usage

Type of Use	Description
EditLimit	Enforce edit limit for posts
Etag	Calculate Etag for HTTP header
Expiry	Enforce the expiry of an object
Filter	Filter a sequence of objects by time
MinElapse	Ensure that a minimum amount of time has elapsed
PostNovelty	Highlight new posts
Sort	Sort a sequence of objects by time
State	Track the state of an object
Timeout	Enforce a timeout

Categories of Programmatic Usage



RQ4: More proportionate/data minimal alternatives



Purpose: Sort, Novelty and Etag

Property Monotonic ordering

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Alternative Sequence or revision numbers

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Property Monotonic ordering

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Example Novelty detection:

1. Add sequence number to post
2. Record last seen seq. number per channel and user
3. On revisits: highlight posts with higher seq. number

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Goal Analysis of timestamp usage and purposes

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Future

- Expansion to other software
- Improvement of the usage analysis (automation, reproducibility)
- Investigation of possible causes (anti patterns)

Contact

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I'd be happy to hear from you!

OpenPGP Fingerprint:

`9B97 CC4B 5FF4 7BA3 EF7B 1966 A5FB 6E0B 41AC CDFB`

Timestamp Type and their Programmatic Usage

Type	Usage Category
Create	EditLimit, Expiry, PostNovelty, Sort, State
Update	Etag, Filter, State
Delete	StateDeleted
LastActivityAt	MinElapse, Timeout
LastViewedAt	PostNovelty
ExpiresAt	Expiry