



Christian Burkert, Hannes Federrath

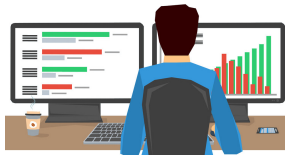
Towards Minimising Timestamp Usage in Application Software

A Case Study of the Mattermost Application

Project: Employee Privacy in Development and Operations



EMPRI-DEVOPS



Project: Employee Privacy in Development and Operations



EMPRI-DEVOPS



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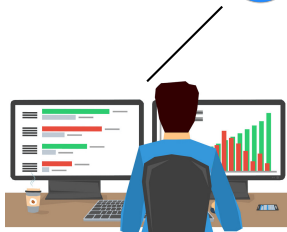
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Project: Employee Privacy in Development and Operations



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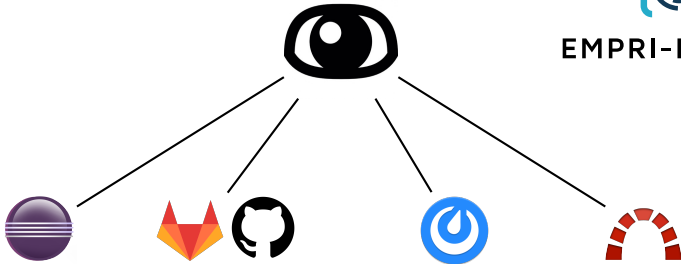
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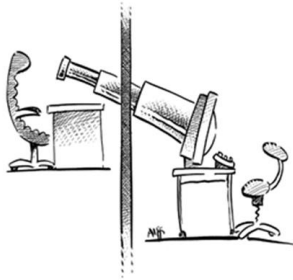
Project: Employee Privacy in Development and Operations



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Monitoring of Employees

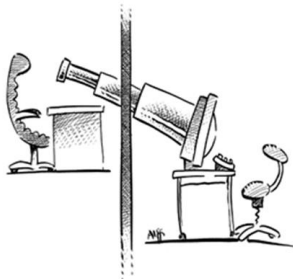


Source: Unabhängiges Landeszentrum für
Datenschutz Schleswig-Holstein (ULD)

Monitoring of Employees

Monitoring

- Performance
Down on Mondays?
- Progress
Stuck on a task?
- Habits
Working after midnight?



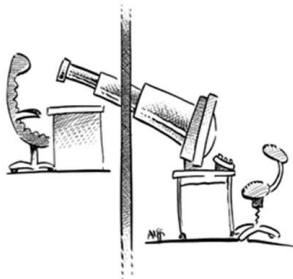
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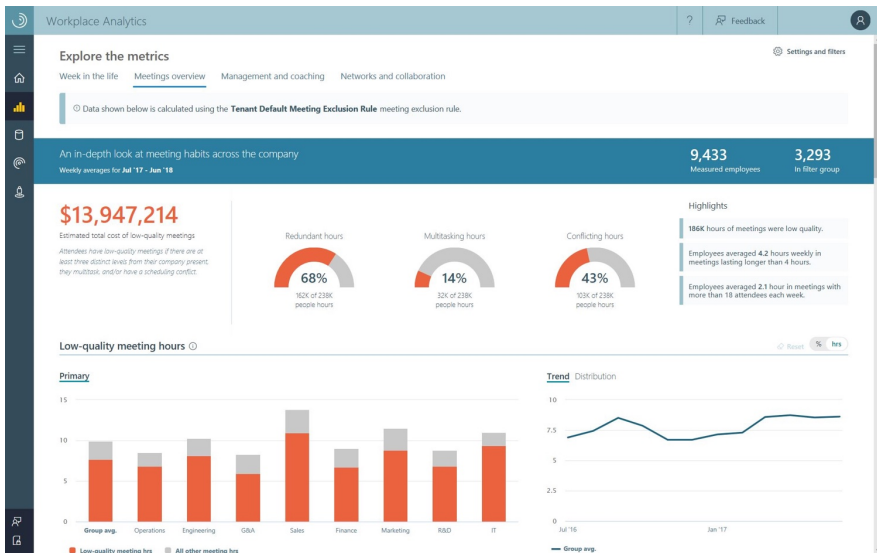
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Employment

- Power imbalance
*Collective measures vs.
individual consent*



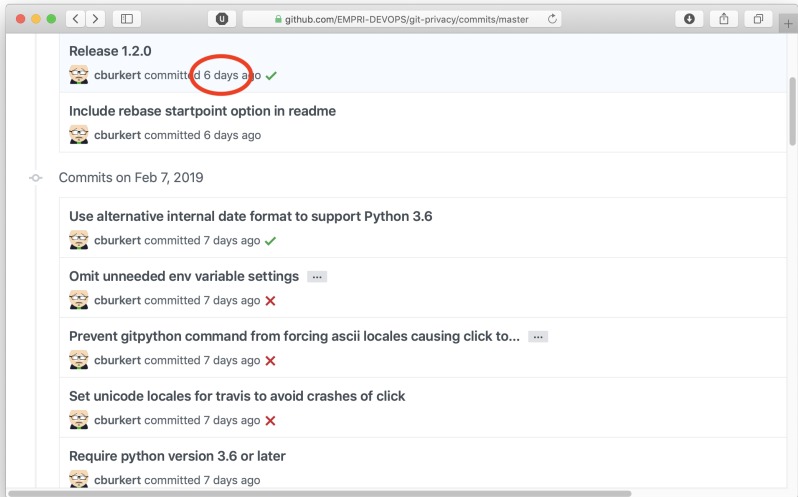
People Analytics: Microsoft Workplace Analytics



People Analytics: IBM Personal Social Dashboard



Timestamp Metadata



Timestamp Metadata: Research Questions

RQ1 Where do timestamps occur in the data model?

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Timestamp Metadata: Research Questions

- RQ1** Where do timestamps occur in the data model?
- RQ2** Which of them are personally identifiable?
- RQ3** For what purpose are they collected/processed?
- RQ4** Are there more proportionate/data minimal alternatives?

Case Study: Mattermost

The screenshot displays the Mattermost web interface for the channel 'electron-mattermost'. The user profile is '@t33 Core'. The channel navigation sidebar on the left lists various channels, with 'Recruiting' selected. The main content area shows a post from user 'sam' 7 minutes ago with the text 'We're recruiting at Stanford tomorrow, has everyone seen the Steve Jobs commencement video?'. The video player shows 'Steve Jobs' 2005 Stanford Commencement A...'. Below the video, user 'tania' has replied 'Yes! Totally ❤️ it!'. A 'System' message from 4 minutes ago is also visible. On the right, the 'MESSAGE DETAILS' panel shows a message from 'matterbot' dated March 15, 2016, 9:34 PM, titled 'Interview: Wendy Jones'. The details include the user's role 'Senior Mobile Developer #college-hire', a mention '@sam final interview 9:00am PST.', and a document attachment 'Wendy Jones.docx' (DOCX 21KB). Below the details, a message from user 'tania' says 'Hire. Really impressed, top 1% 🎉'. A comment input field and an 'Add Comment' button are at the bottom right of the message details panel.

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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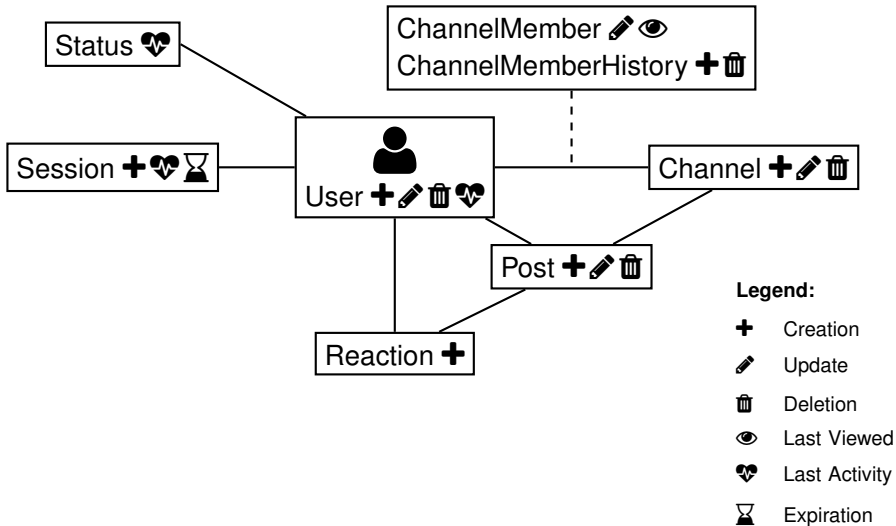
RQ3 For what purpose are they collected/processed?

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

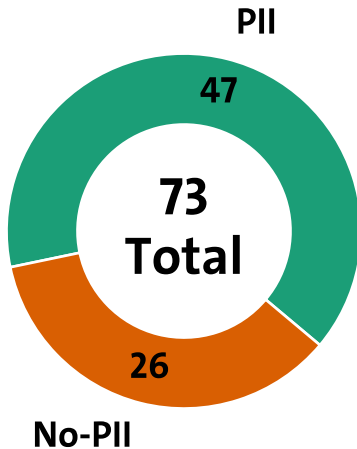
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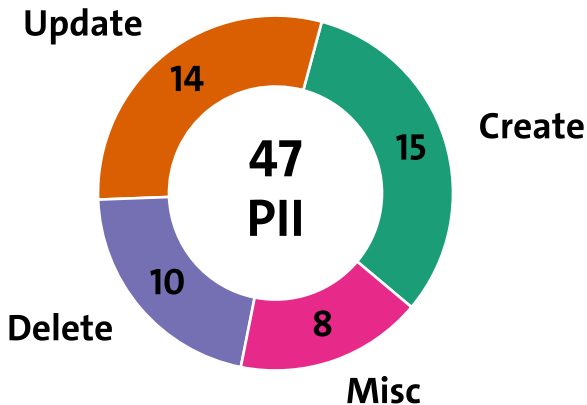
Timestamps in Mattermost's Data Model (Excerpt)



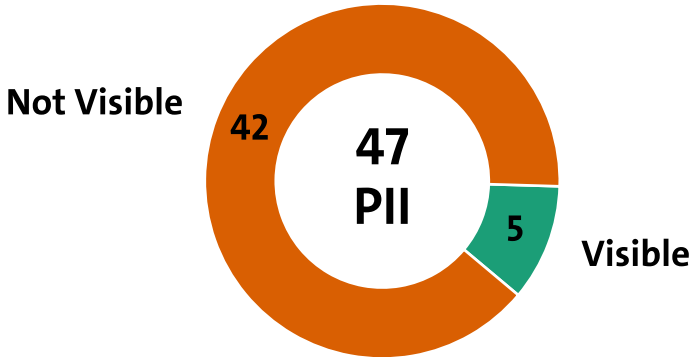
PII vs. Non-PII Timestamps



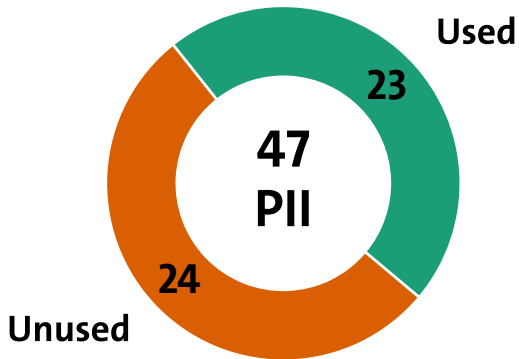
Timestamp Types



Visibility for Users



Programmatic Usage



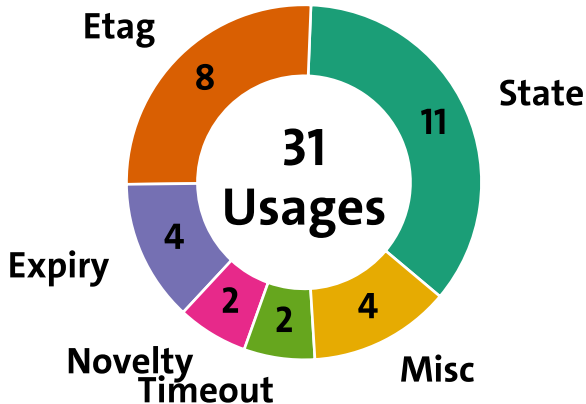
Distribution of Types between Used and Unused



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

	Sequence Number	Revision Number	Reduction	Encryption	Enumeration
EditLimit			●		
Etag	●				
Expiry			●		
Filter			●		
MinElapse			●		
Novelty	●				
Sort	●				
State					●
Timeout			●		
User Information			●	●	

Purpose: Sort, Novelty and Etag

Property Monotonic ordering

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Alternative Sequence or revision numbers

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Property Monotonic ordering

Alternative Sequence or revision numbers

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

Mattermost Case Study: Summary

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Limitation Case study is not representative

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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
