Log Design for Accountability

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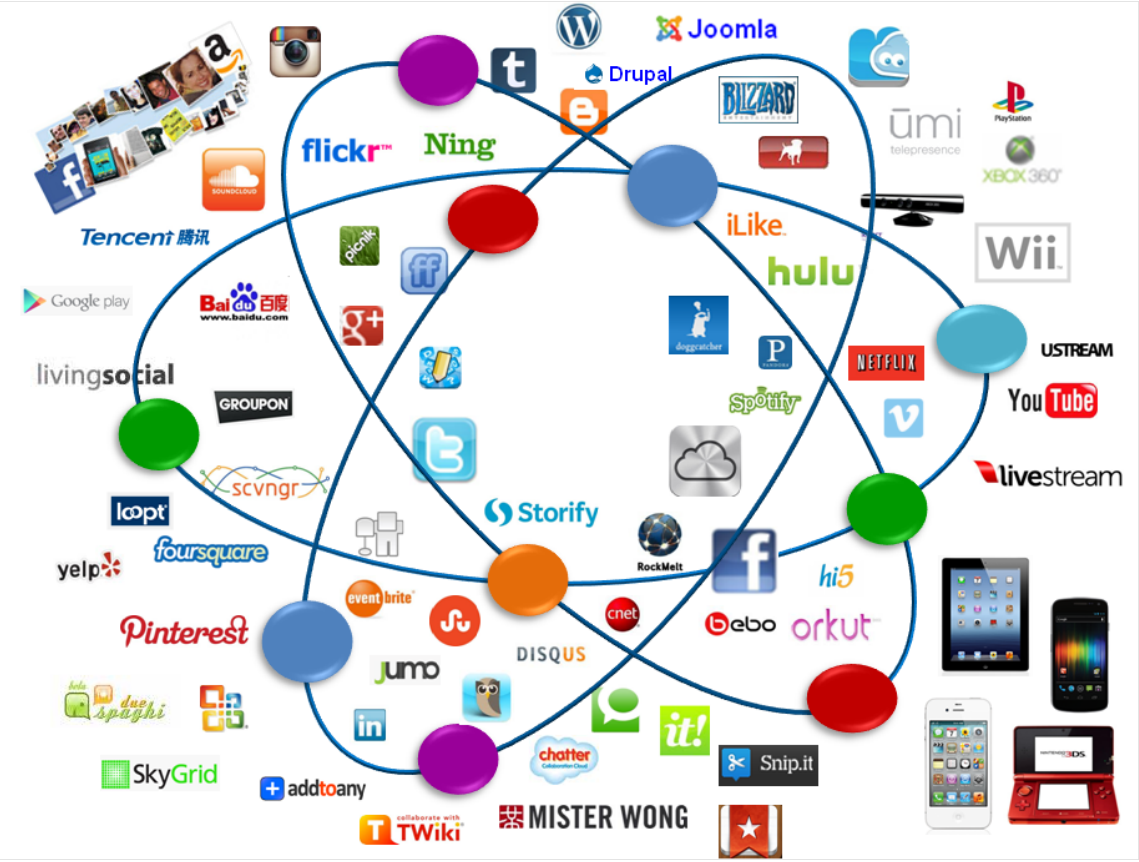
Background

Individuals share more & more PII (Personally Identifiable Information)



Stronger privacy guarantees, more transparency needed

Privacy Impact Assessment

- Modern analytic approach to mitigate privacy risks
- Done before deployment
- No guarantees to users about actual running system

Motivation (1/2)

- Runtime / a posteriori verifications needed!
- "Proven trust" instead of "blind trust"
- Data controllers should be accountable to data subjects
- Practical requirements?

Motivation (2/2)

- Need to provide the means to check that policies were complied with
- Approach: check PII handling event logs against policies, automatically
- Duality — if PIA done right (*implies* design choices), accountability possible (*depends* on design)

What is Accountability?

- Obligation to accept responsibility for actions
- Attributability: who did what?
- Non-repudiable evidence that cannot be falsified
- Transparent use of information

Enabling Accountability (1/2)

- Accountability does not emerge spontaneously
- Feasibility of comprehensive a posteriori verification?
- Depends directly on technical architecture!

Example — requirements on logs for accountability

Timestamps needed in logs if notification to data subject within an hour required when sharing their age with a third party

Enabling Accountability (2/2)

Need to define:

- Obligations to be met $\Longrightarrow$ Policy language
- Compliance checking evidence $\Longrightarrow$ Log architecture
- Compliance checking procedure $\Longrightarrow$ Log analyzer

Usage Policy Languages

- Almost no one reads lengthy text-formatted privacy policies ...
- ... Usage policy languages allow data handling details to be standardized, set and matched!
- On both sides: data subject (preferences), data controller (policies).
- Examples: P3P, EPAL, XACML

Primelife Policy Language (PPL) (1/3)

- Access and data usage policy language, developed by SAP (European project PrimeLife)
- Extends XACML with usage control features ; uses SAML protocol language
- Symmetric architecture (data subject side / data controller side) yields *Sticky Policies* (agreements)

Primelife Policy Language (PPL) (2/3)

- Automated matching of
  - Data Subject (Data Handling Preferences) &
  - Data Controller (Data Handling Policies)
- Wide range of obligations possible (trigger + action)
- Authorizations
  - Use for a specific purpose
  - Downstream (third party) usage

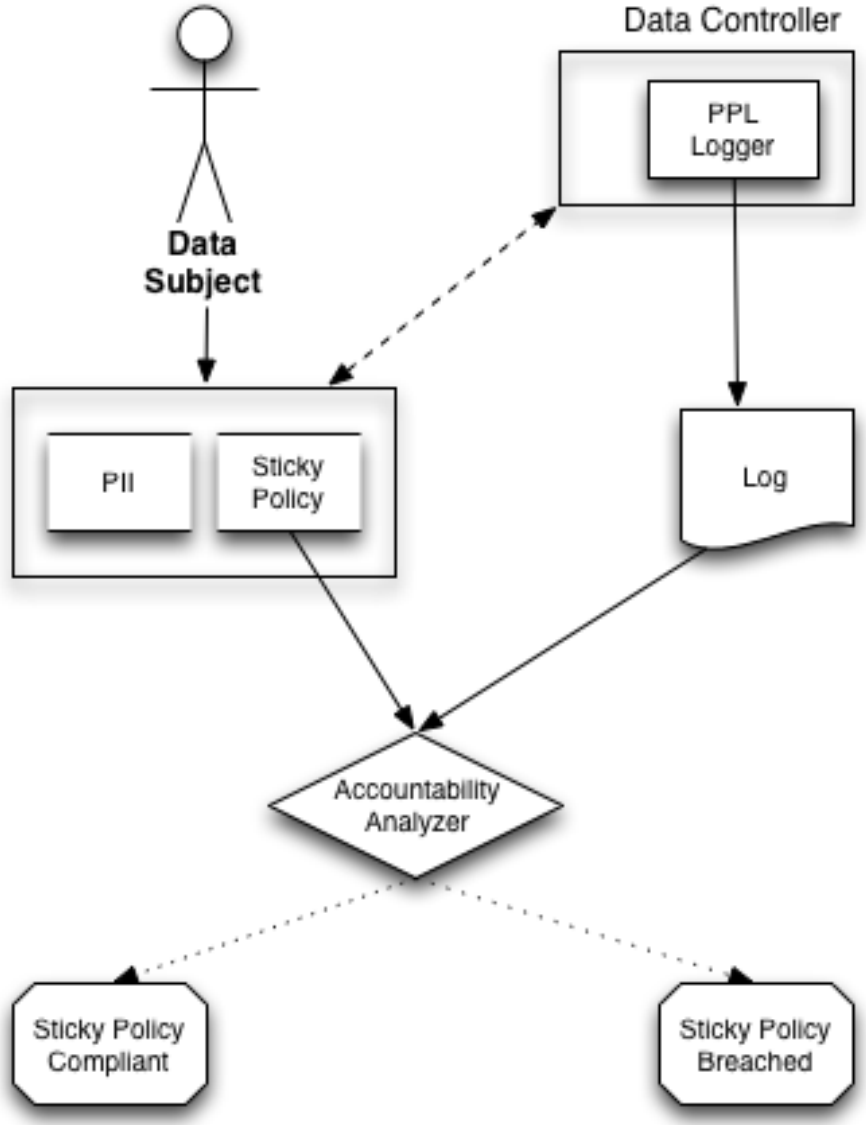
Primelife Policy Language (PPL) (3/3)

- Only informal specification available until our work
- Trigger examples: At time / periodic / on PII deletion / on PII access for purpose ...
- Action examples: Delete PII / encrypt PII / notify DS / log ... (usually before a set deadline)

PII Event Logging

- Data Controller must provide evidence that agreements met
- Audit possible through inspection of a log against the corresponding sticky policy
- Structure of logs conditions auditability, hence accountability
- Deciding what to include in logs — not a trivial task

Architectural Overview



Contribution: Formalising PPL

- Relevant events precisely defined (syntax) / ambiguities identified
- Compliance properties described (semantics)
- Tool built for automated compliance checking — Haskell implementation
- Policy matching supported
- Reasoning over compliance can be generalised

Guidelines for Log Design

- Importance of explicitness — sufficiently detailed event information needed
- Avoid ambiguity; reflect causal relationships
- Accountability definitions shape log structure & vice versa
- Include contextual information if obligation of performance

Future Work

- Currently: Bridge between abstract and real logs (parsing) — evolving requirements
- Correctness proof for log compliance analyser (formal methods)
- Accountability-oriented, standardised log format (policy language-independent)
- Detailed case studies illustrating design guidelines