On Parametric Obligation Policies:

Enabling Privacy-aware Information Lifecycle Management in Enterprises

IEEE Policy Workshop 2007

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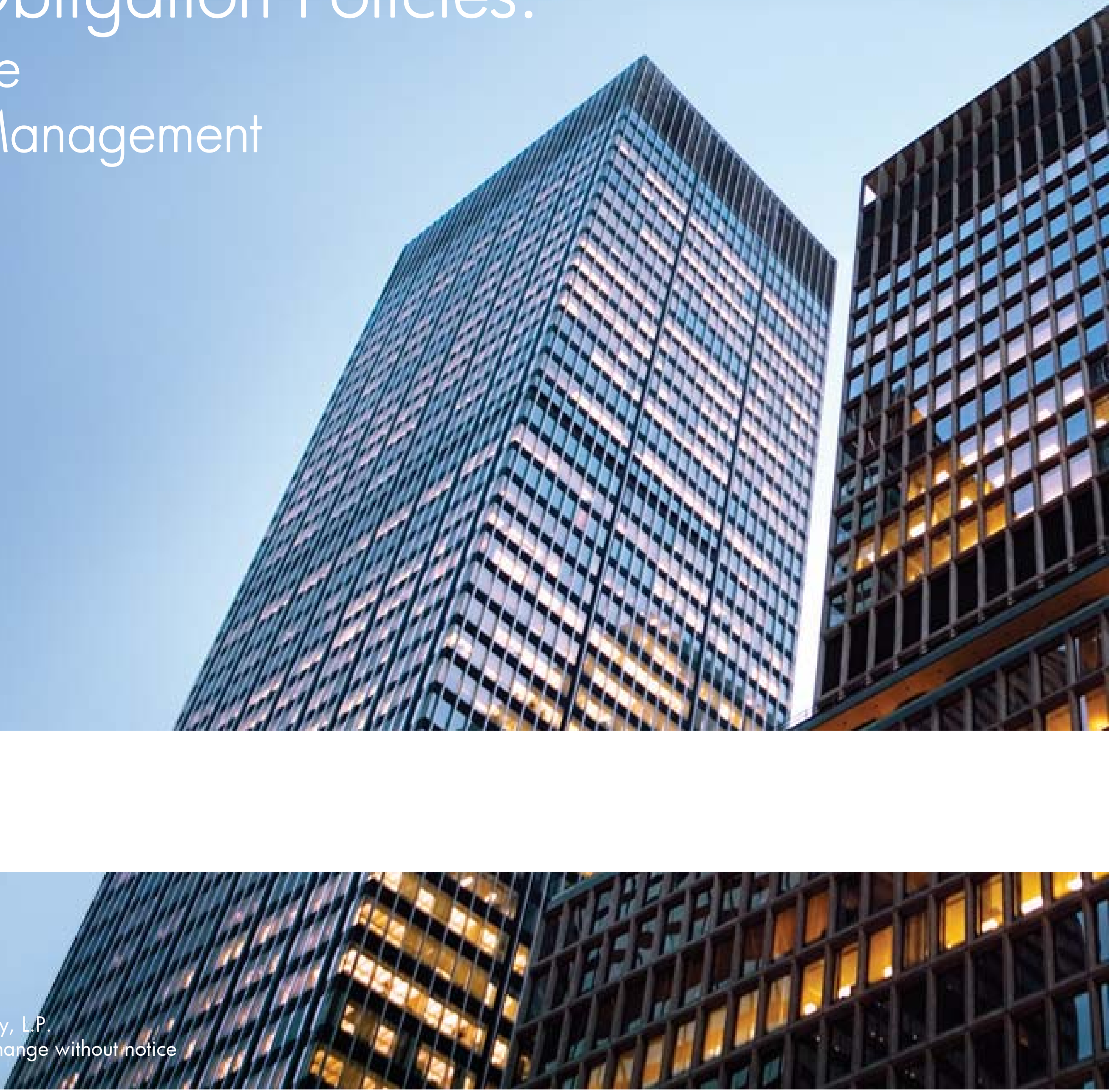
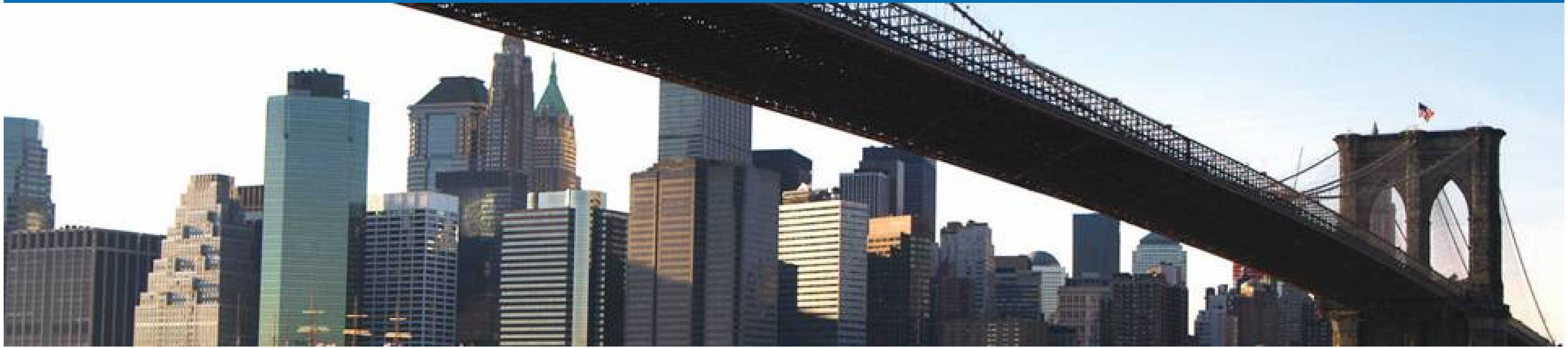


Presentation Outline

- Background on Privacy Obligation Management
- Addressed Problem and Related Work
- Scalable Obligation Management
- Conclusions



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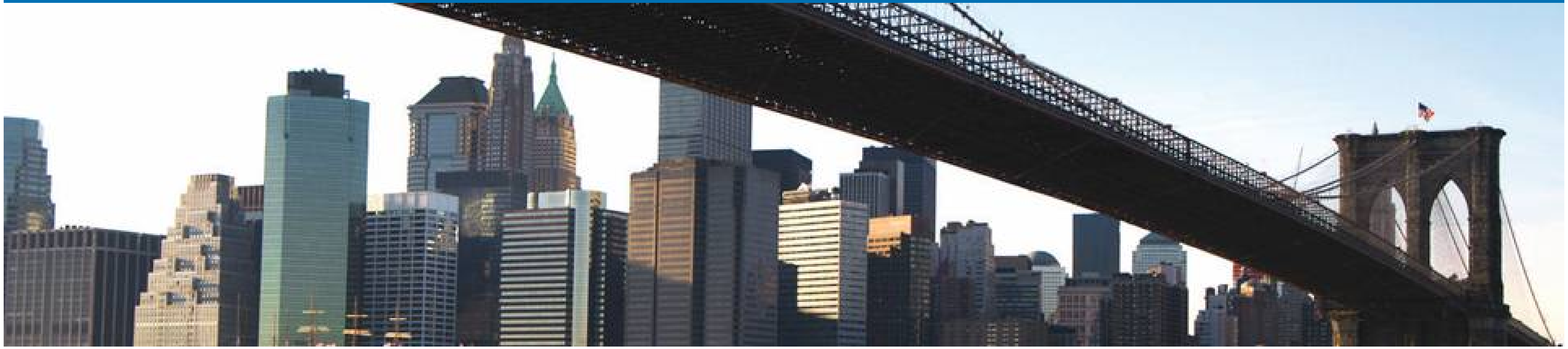
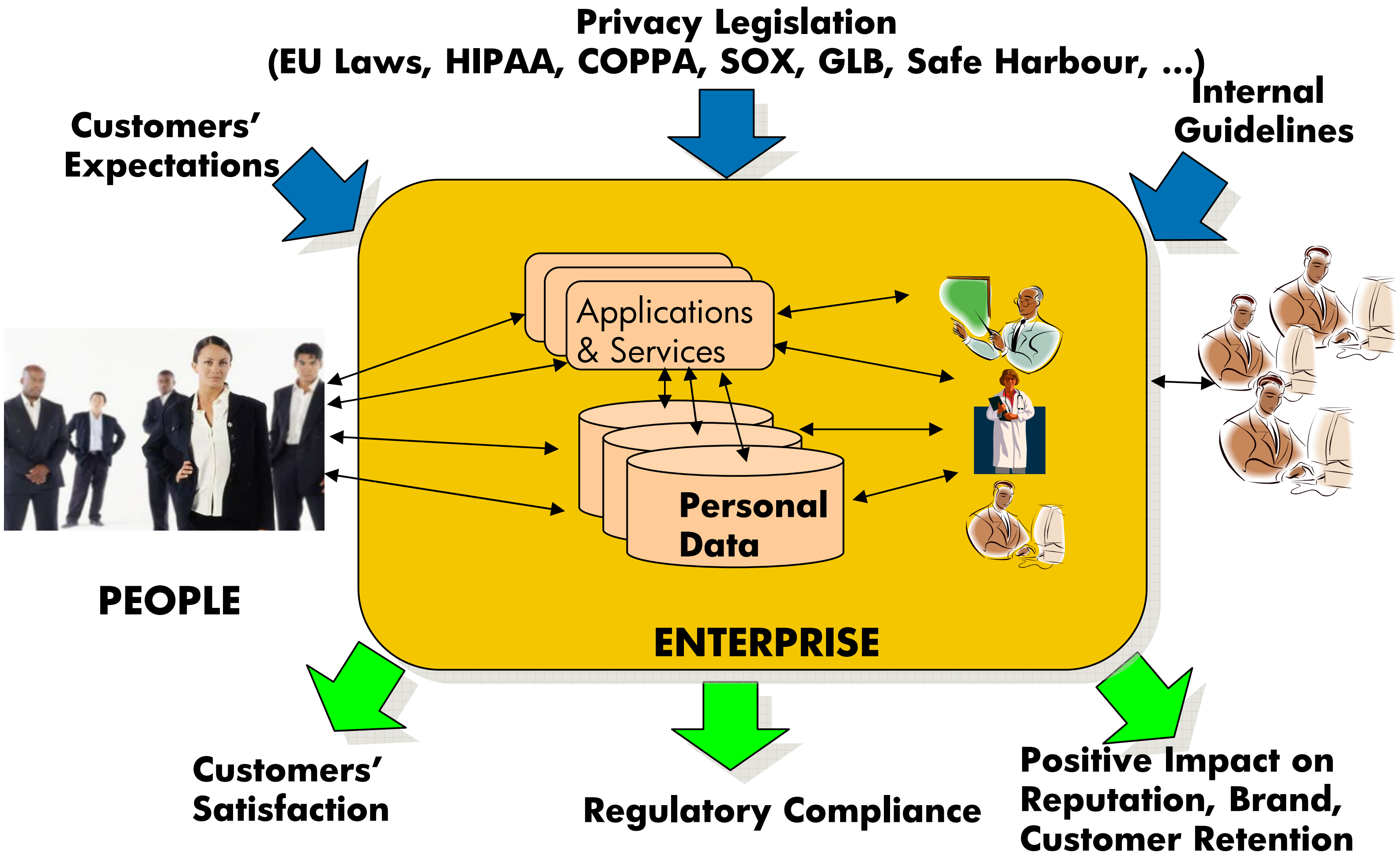


Privacy: Impact on Users and Enterprises



Privacy Legislation
(EU Laws, HIPAA, COPPA, SOX, GLB, Safe Harbour, …)

Customers' Expectations

Internal Guidelines

Applications & Services

Personal Data

PEOPLE

ENTERPRISE

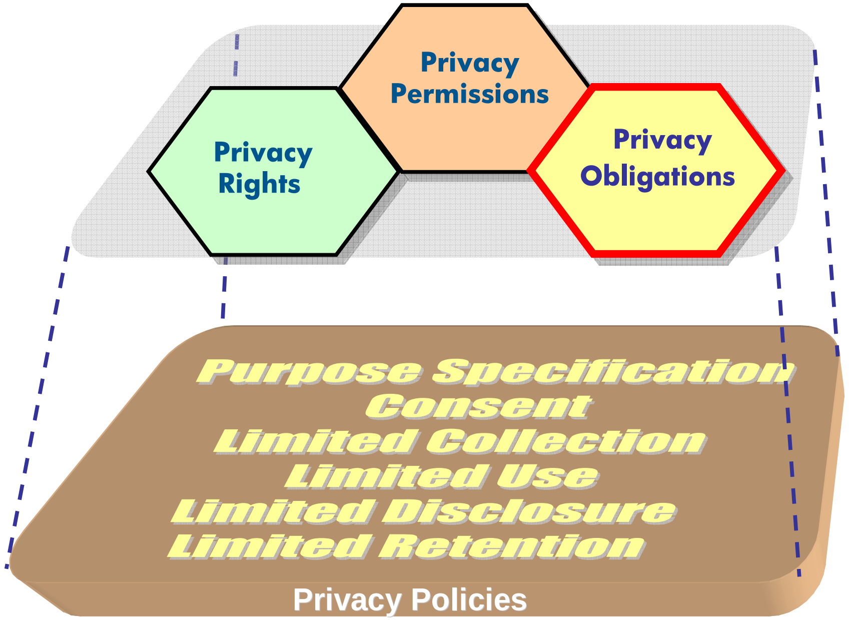
Customers' Satisfaction

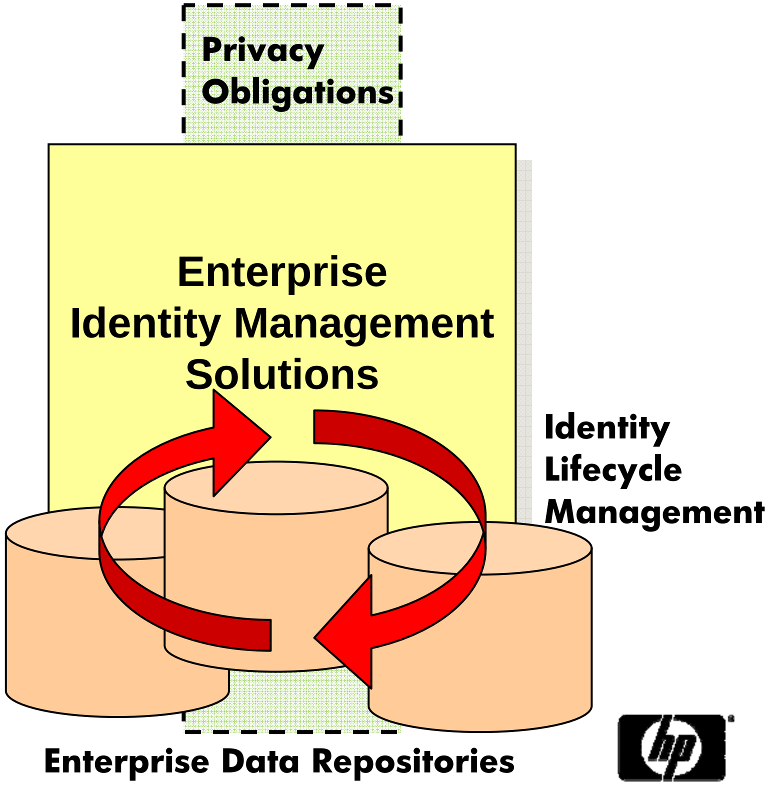
Regulatory Compliance

Positive Impact on Reputation, Brand, Customer Retention

Privacy Obligation Policies

- Privacy Obligations are Policies that describe Duties and Expectations on how Personal Data (PII) Should be Managed in Enterprises (e.g. Data Deletion, Retention, Notifications, Data Transformation, …)
- They dictate "Privacy-aware (Identity) Information Lifecycle Management"
- They can be defined by Privacy Laws, Data Subjects (Users)' Preferences and Enterprise Guidelines

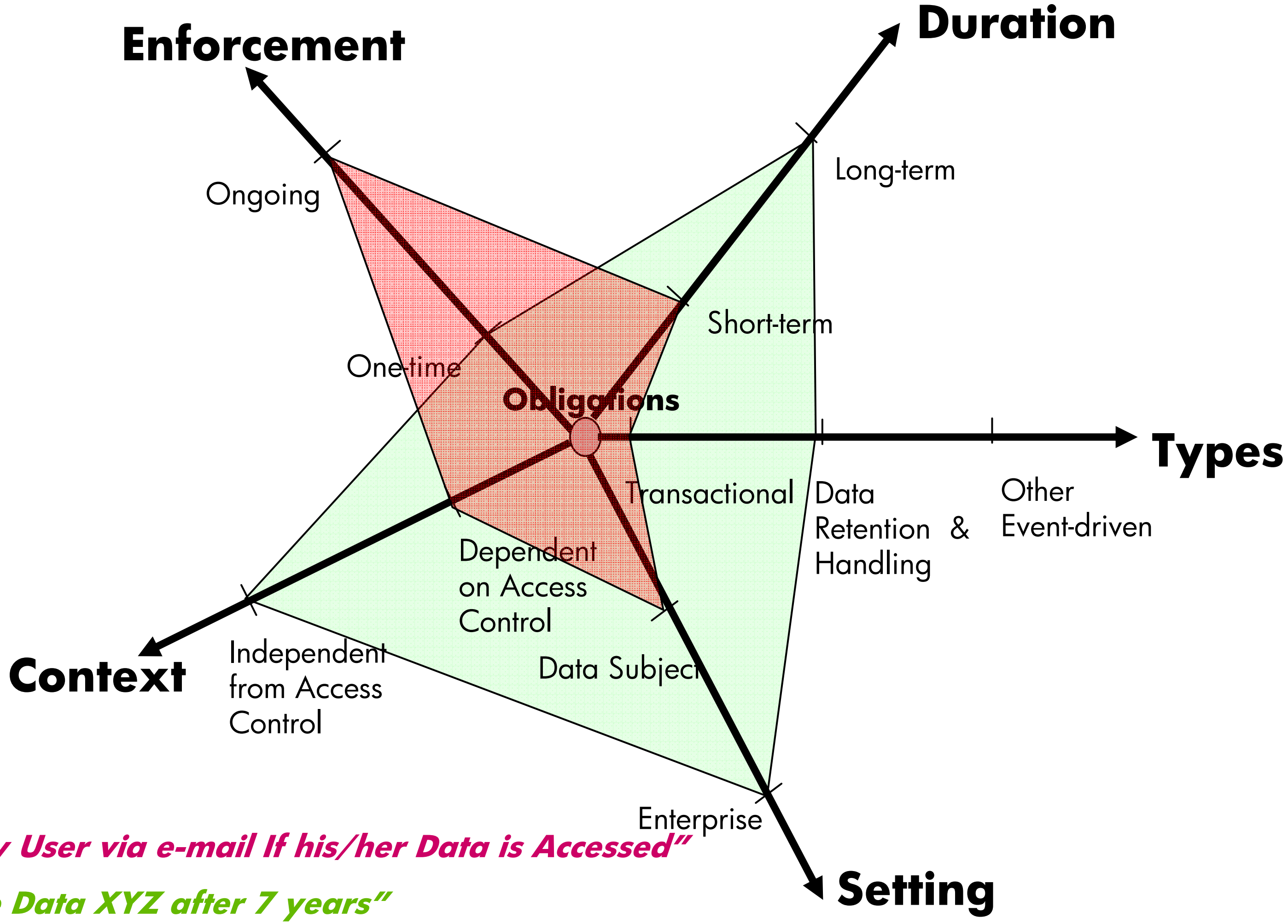



Privacy Obligations
Enterprise Identity Management Solutions
Identity Lifecycle Management
Enterprise Data Repositories

Privacy Obligations: A Complex Topic …

Obligation Constraints:

- Notice Requirements
- Enforcement of opt-in/opt-out options
- Limits on reuse of Information and Information Sharing
- Data Retention limitations …



"Notify User via e-mail If his/her Data is Accessed"

"Delete Data XYZ after 7 years"

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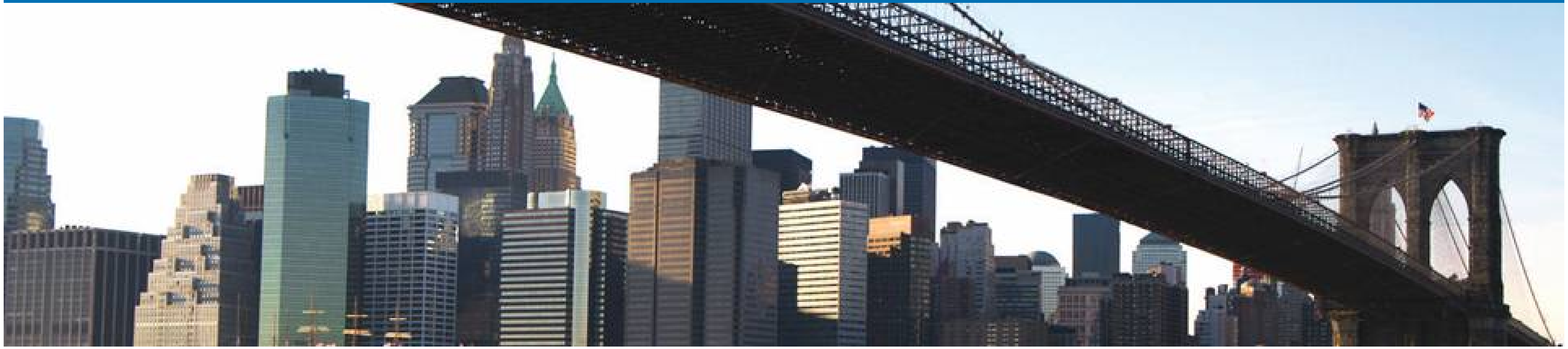

Key Research Problems

- How to Help Enterprises to Handle Obligation Policies:
  - How to Represent Privacy Obligations?
  - How to "Stick" them to Data?
  - How to Manage, Enforce and Monitor Them?
  - How to Leverage Current Identity Management Solutions?

- How to Achieve this in a <u>Scalable Way</u>, with <u>Very Large Sets</u> of Managed Personal Data (>100K, usually million of records …)

Technical Work in this Space (Privacy Obligation Management)

- P3P (W3C):
  - Definition of User's Privacy Expectations
  - Explicit Declaration of Enterprise Promises
  - No Definition of Mechanisms for their Enforcement

- Data Retention Solutions, Document Management Systems, Ad-hoc Solutions for Vertical Markets
  - Limited in terms of expressiveness and functionalities.
  - Focusing more on documents/files not personal data

- IBM Enterprise Privacy Architecture, EPAL, XACML …

- No Refined Model of Privacy Obligations
- Privacy Obligations Subordinated to AC. Incorrect …
- No Focus on Scalability Issue …

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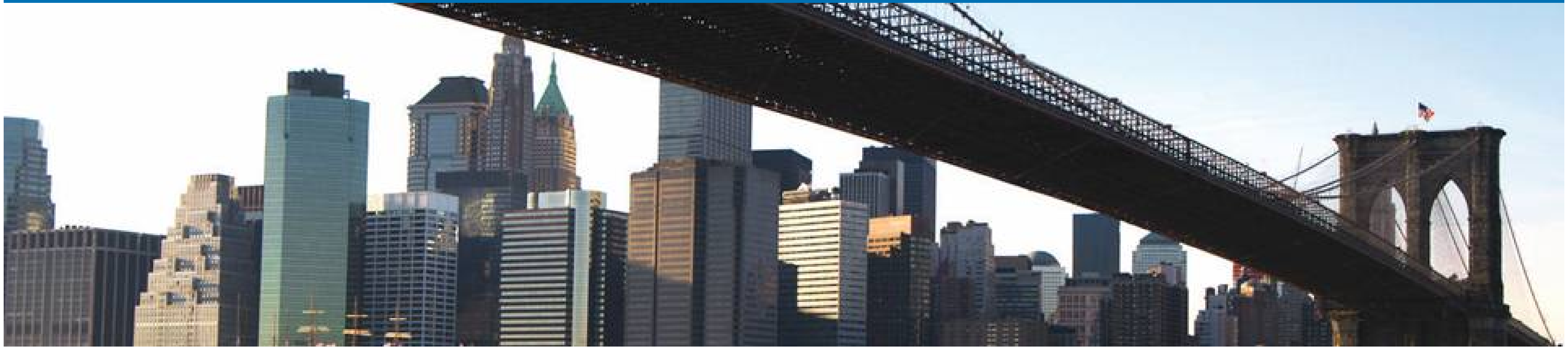


Our Approach (EU PRIME Project)

- Privacy Obligations are “First-Class Entities”:
  No Subordination to Access Control/Authorization View

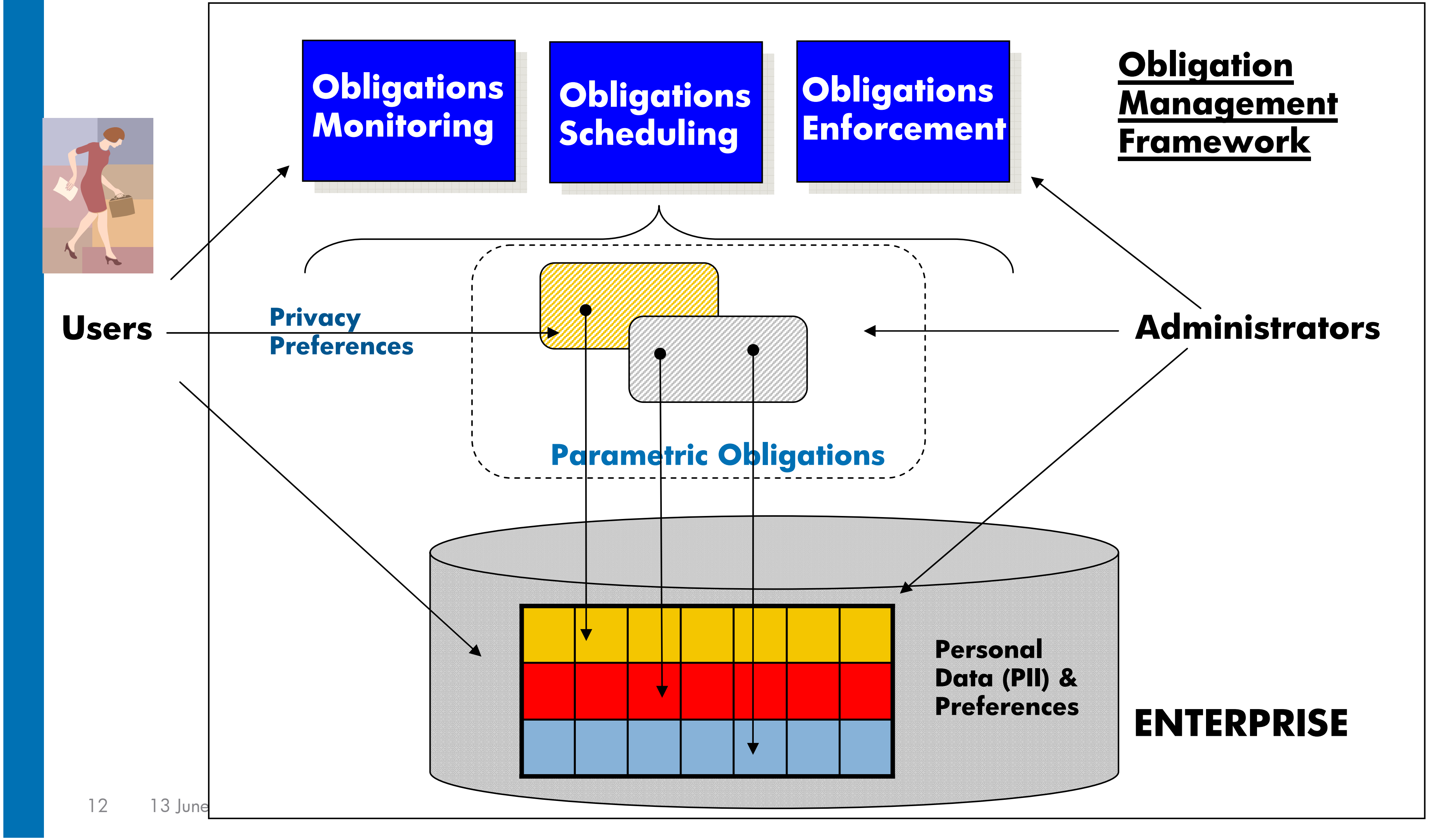
  → Explicit Representation, Management
  and Enforcement of Privacy Obligation Policies

- Allow Users to Express their Privacy Preferences
  that are Mapped into Enterprises’ Obligation Policies

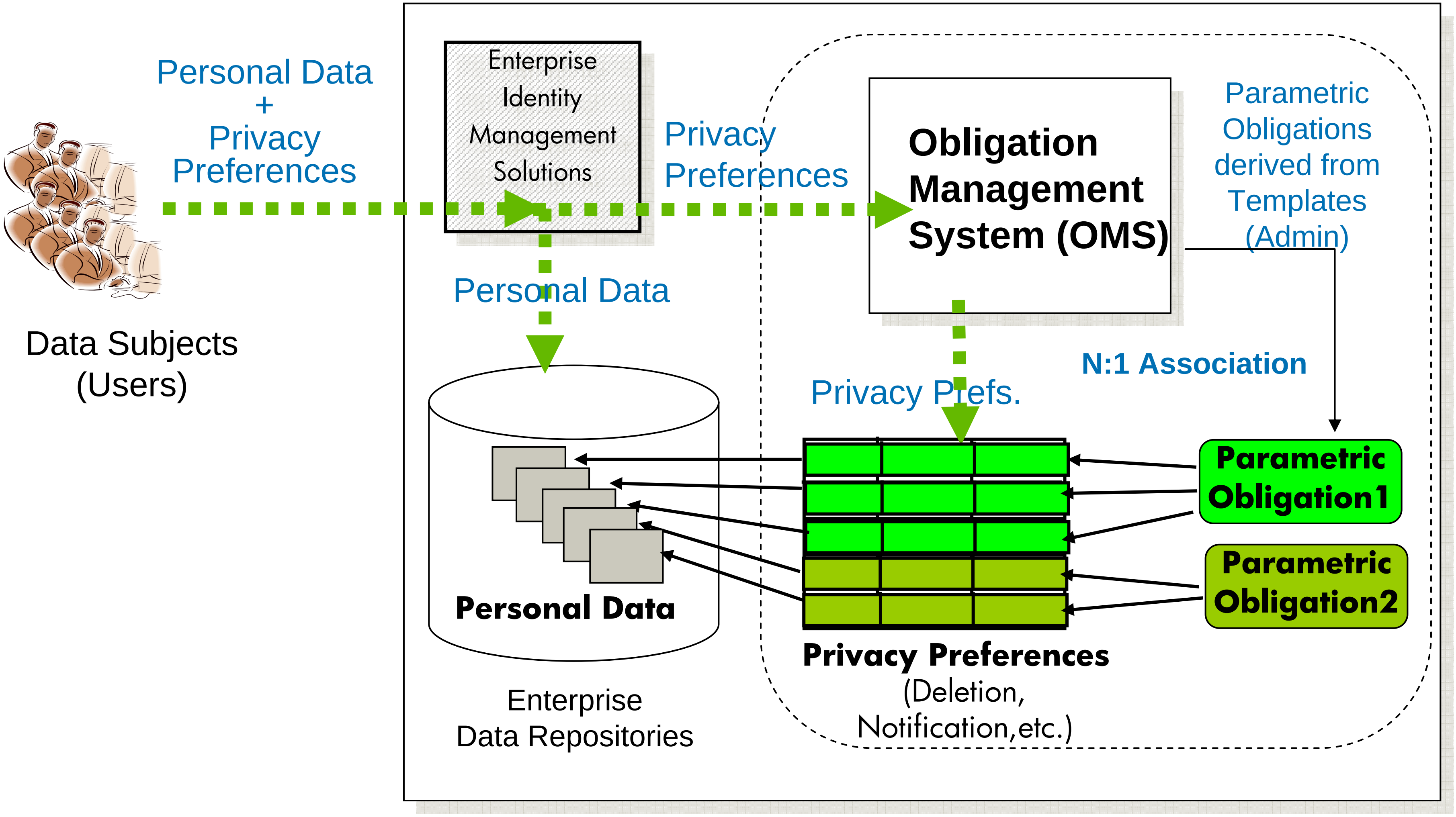
- Scalability to Large data sets (>100K) by means of
  Parametric Obligation Policies

- Provide a Solution to Enterprises to Automate the Management
  and Enforcement of Privacy Obligation Policies

Our Model: Obligation Management Framework [1/2]



Our Model: Obligation Management Framework [2/2]



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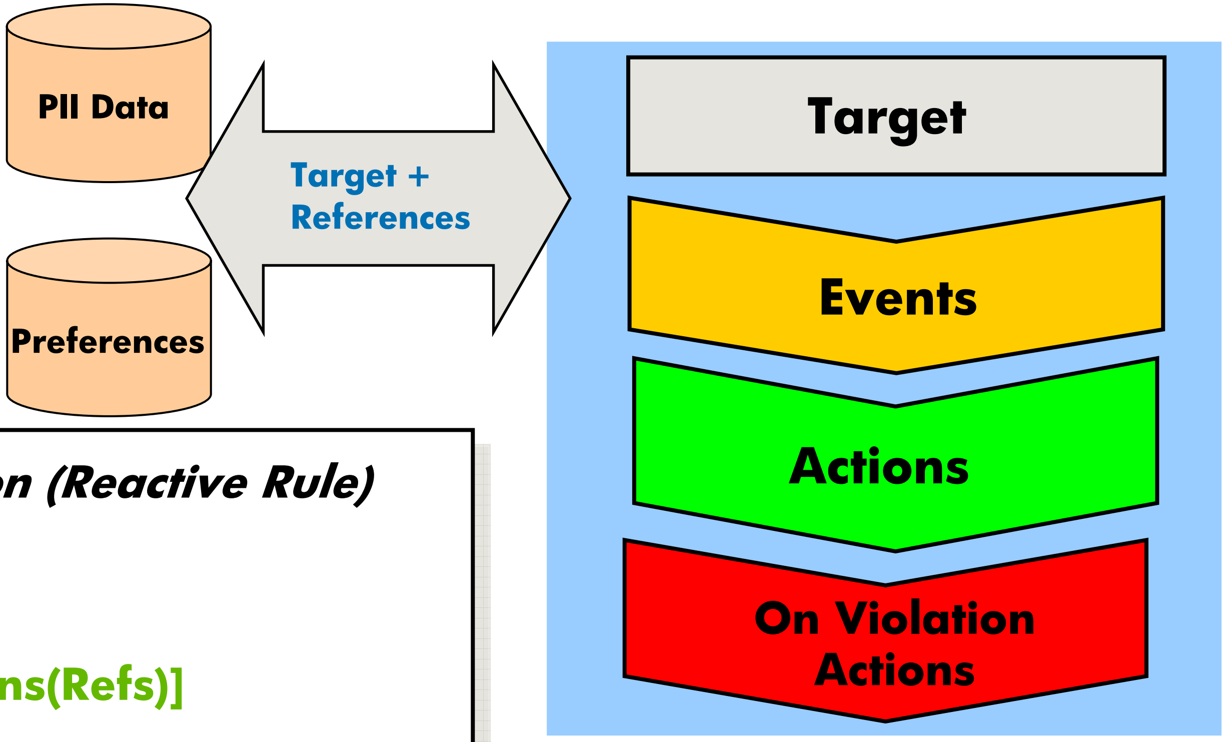
Parametric (Privacy) Obligation Policies

- Parametric Obligation: contains a "parametric definition" of Obligation's Target, Events, Actions (and On-Violation Actions …)
- Structure based on Predefined Obligation Templates. Once Instantiated, it contains References to Personal Data and Privacy Preferences
- References are Resolved at Runtime by OMS



Parametric Obligation

Parametric Obligation (Reactive Rule)

```
FOR: Target
WHEN Events(Refs)
THEN EXECUTE [Actions(Refs)]
ON VIOLATION:
        EXECUTE [Violation-Actions(Refs)]
```

Parametric Obligation: “Simple” XML-based Example …

Target with the references description of the databases

```
<obligation ObligationId=“OBLID1”>
     <target>
          <DataRepositories>
               <Repositories>
                    <DataRepository alias= "CDB">
                         <drType>RDBMS_DATABASE </drType>
                         <DBname>oms_demo-customerdb</DBname>
                         <TableName>piidata</TableName>
                         <Conditions>
                              <Condition> ZipCode != '' </Condition>
                         </Conditions>
                         <UniqueIdentifier>
                              <References>
                                        <Reference>@key:UID</Reference
                              </References>
                         </UniqueIdentifier>
                    </DataRepository>
               </Repositories>
               <InternalLinks>
                    <Link>  </Link>
               </InternalLinks>
          </DataRepositories>
          <PreferenceRepositories>
               <Repositories>
                    <DataRepository alias= "PPDB">
                         <drType>RDBMS_DATABASE </drType>
                         <DBname>oms_demo-soms</DBname>
                         <TableName>privacypreferences</TableName>
                         <UniqueIdentifier>
                              <References>
                                        <Reference>@key:UID</Reference
                              </References>
                         </UniqueIdentifier>
                    </DataRepository>
               </Repositories>
               <InternalLinks>
                    <Link> </Link>
               </InternalLinks>
          </PreferenceRepositories>
          <CrossLinks>
               <Link> CDB.UID = PPDB.UID </Link>
          </CrossLinks>
     </target>
<metadata>
     <type>Parametric</type>
     <description>
          Delete creditcard WHEN Timeout Occurs
     </description>
</metadata>
<events operator="OR">
     <event id="e1">
          <type>TIMEOUT</type>
          <date now="no">
            [#ref] NOW > PPDB.GeneralTimePreference
          </date>
     </event>
</events>
<actions>
     <action id="a1">
          <type>DELETE</type>
          <data attr="part">
            <item> [#ref] CDB.CreditCardReference </item>
            <item> [#ref] CDB.CreditCardNumber </item>
            <item> [#ref] CDB.CreditCardExpirationDate </item>
          </data>
      </action>
     <action id="a2">
          <type>NOTIFY</type>
          <method>EMAIL</method>
          <to> [#ref] CDB.Email </to>
          <text> some e-mail text here </text>
     </action>
 </actions>
<onviolation>
     <attempts> 50 </attempts>
     <ovaction id="ova1">
          <type> REENFORCE </type>
          <do> Only-Violated </do>
     </ovaction>
     <ovaction id="ova2">
          <type>NOTIFY</type>
          <method>EMAIL</method>
          <to> [#val] filipe.beato@hp.com </to>
          <text> some e-mail text here </text>
      </ovaction>
</onviolation>
</obligation>
```

Timeout Event using the explicit reference

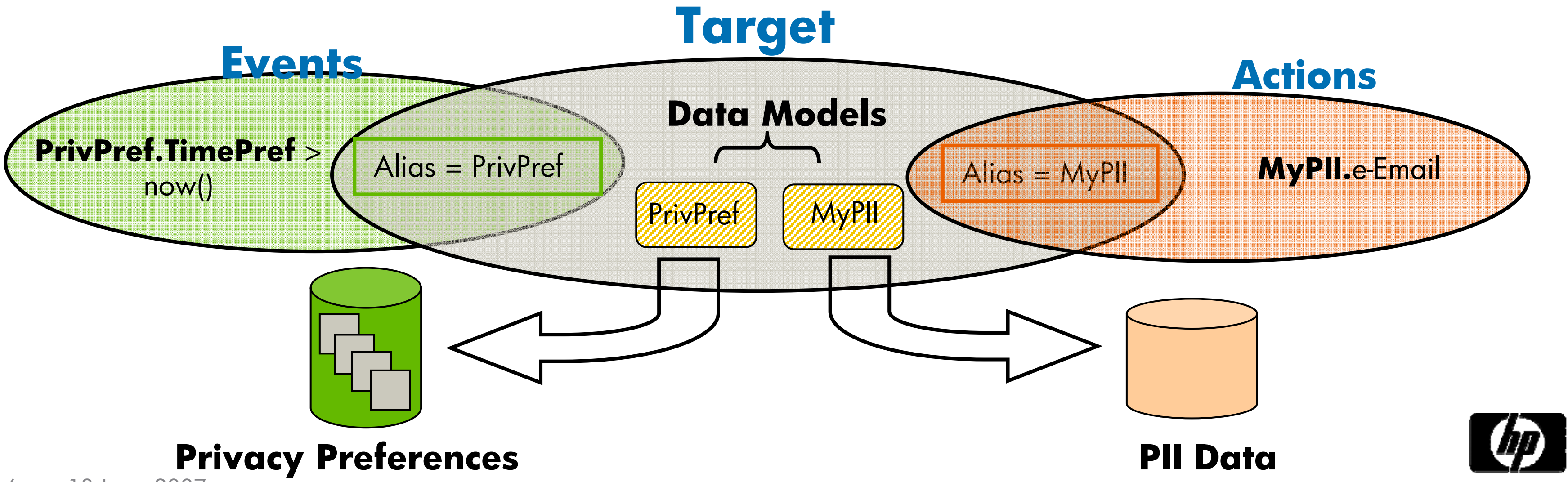
Actions involving the Notification and Data Deletion

On Violation Actions using the direct value

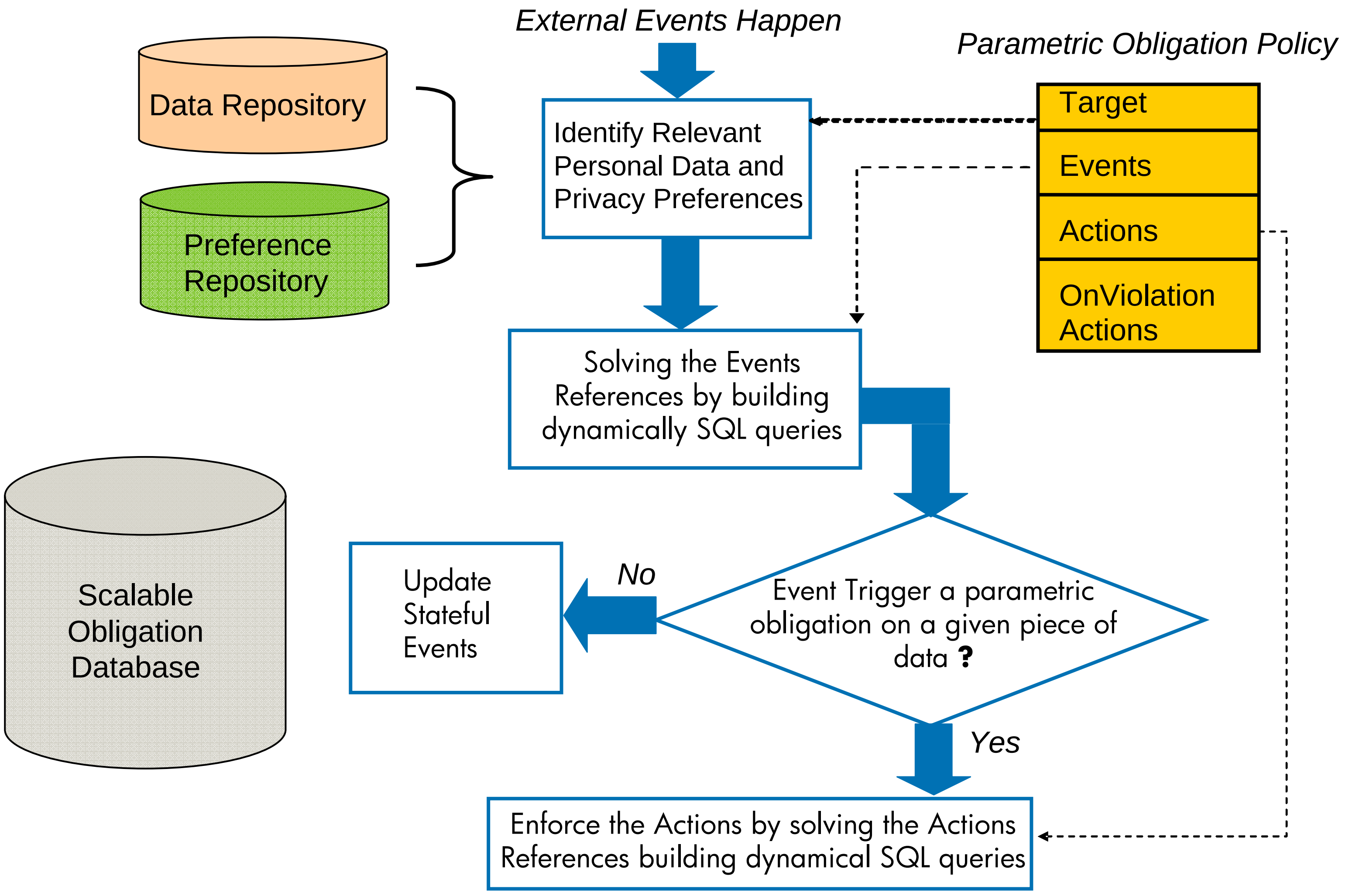
FOR ALL TARGETED PII DATA + RELATED PREFS
WHEN Deletion_Time (Ref)
THEN EXECUTE [DELETE CreditCard (Ref) & Notify (Ref)]
ON VIOLATION: EXECUTE [Notify(admin)]

Parametric Obligation: Working with References …

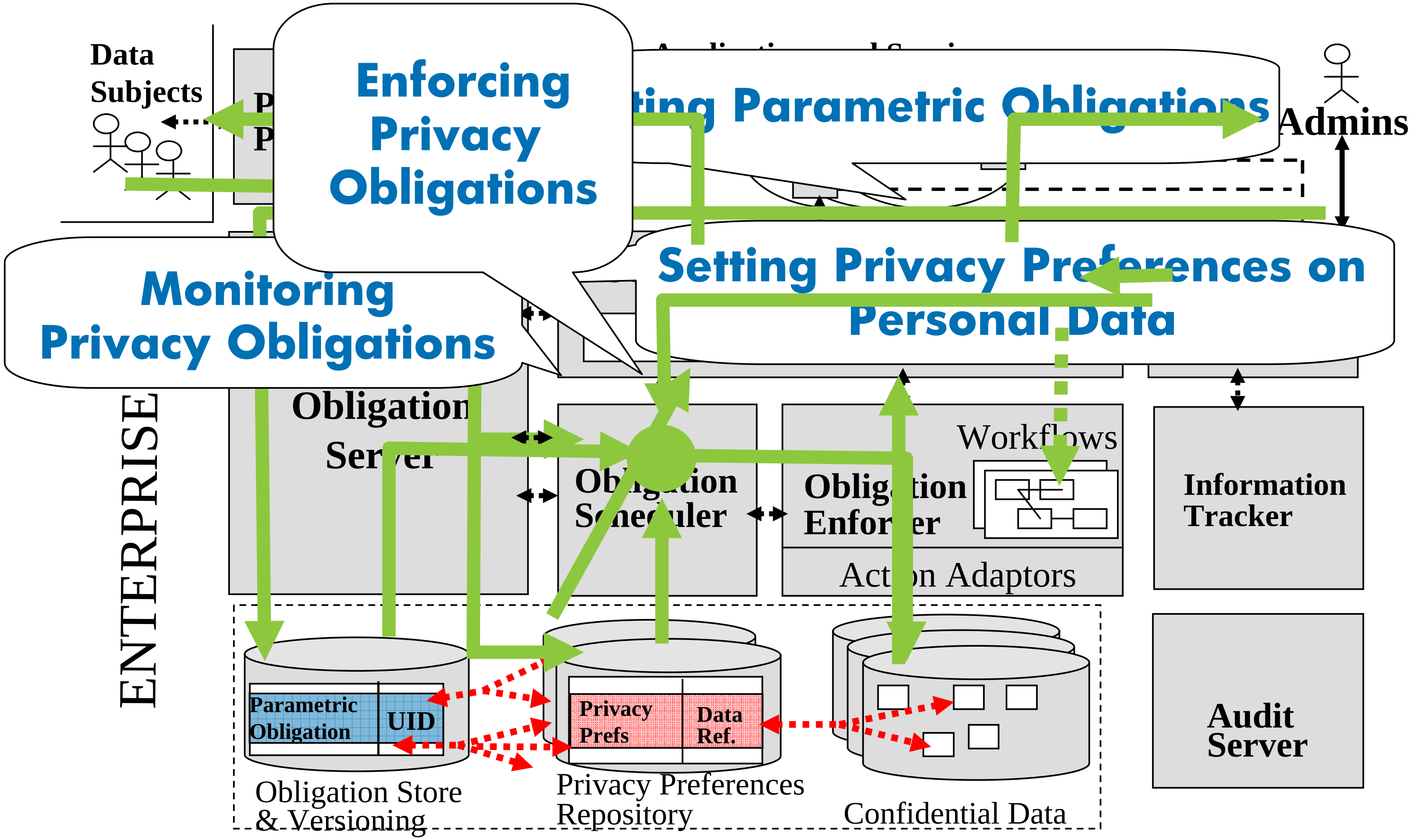
- **Target**
  - Data Model Definition (PII Data, Preferences, etc.)
  - Uses Alias to identify each data model
- **Events**
  - Uses the "Alias + References" to get the data to trigger the action
- **Actions**
  - Uses the "Alias + References" to acquire additional information to enforce the action



Obligation Processing Workflow (Run-time …)


External Events Happen
Parametric Obligation Policy
Data Repository
Preference Repository
Identify Relevant Personal Data and Privacy Preferences
Target
Events
Actions
OnViolation Actions
Solving the Events References by building dynamically SQL queries
Scalable Obligation Database
Update Stateful Events
No
Event Trigger a parametric obligation on a given piece of data ?
Yes
Enforce the Actions by solving the Actions References building dynamical SQL queries

Scalable OMS High-Level Architecture



Current Status

- Full working prototype. Tested with Large data sets (>100K)
- Integrated with HP OpenView Identity Management Solution (HP Select Identity)
- Working on further Tests and Analysing them …

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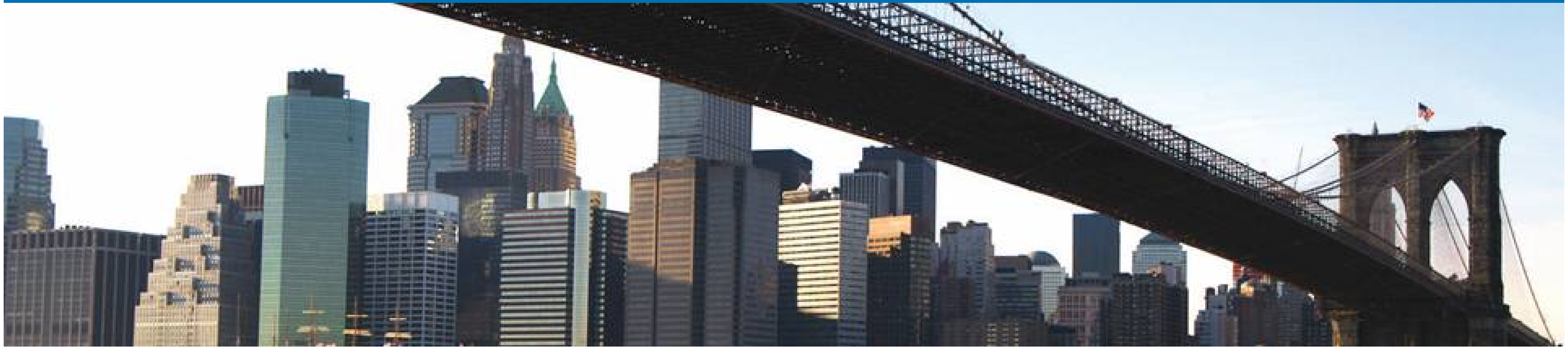

Conclusions

- Privacy Management is Important for Enterprises
- Need to Provide Scalable Solutions to Handle Privacy Obligations
- Proposed a Scalable Obligation Management Framework and Solution
  - Explicit Modelling and Management of Obligation Policies
  - Concept of Parametric Obligation Policies
- It Works!! Handling Obligations on Large set of PII Data (>100k)
- Collecting Test Results and more Formal Analysis …
- R&D Work in Progress:
  - Stickiness of Obligation Policy to Data (subject to change of locations)
  - Management of Obligation Policies in Federated Identity Management Contexts
  - …

invent