Mobile, Context and Entities

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Motivation

- Context - "any information that can be used to characterize the situation of an entity"

  - Entity could be a relevant person or place

- Mobile devices

  - Portable, Ubiquitous, Data rich

  - *Apps have different aspects of user's context*

- Using phone data for context-aware solutions

Presentation

- Brodt, Andreas, et al. "A mobile data management architecture for interoperability of resource and context data." Mobile Data Management (MDM), 2011 12th IEEE International Conference on. Vol. 1. IEEE, 2011.

- Sebillo, Monica, et al. "Combining personal diaries with territorial intelligence to empower diabetic patients."

Interoperability

- Apps
  - *"Ivy called 3 times, texted 10 messages, is on 34 photos"*
- Spatial data
  - *"Where was I when Ivy called"*
- Web data
  - *"IFFT wants to know about Ivy"*
- Between phones
  - *"Ivy's phone is 100 yards away"*

State of the Art

- Domain specific APIs

  - apps provide API to data silos

  - too generic, inflexible

- Semantic web

  - RDF and SPARQL, model structured data

  - Suited for multimedia data

- Interoperability with web applications

  - ***"Google Maps would like to access your location"***

  - Calendar, Contacts, Camera

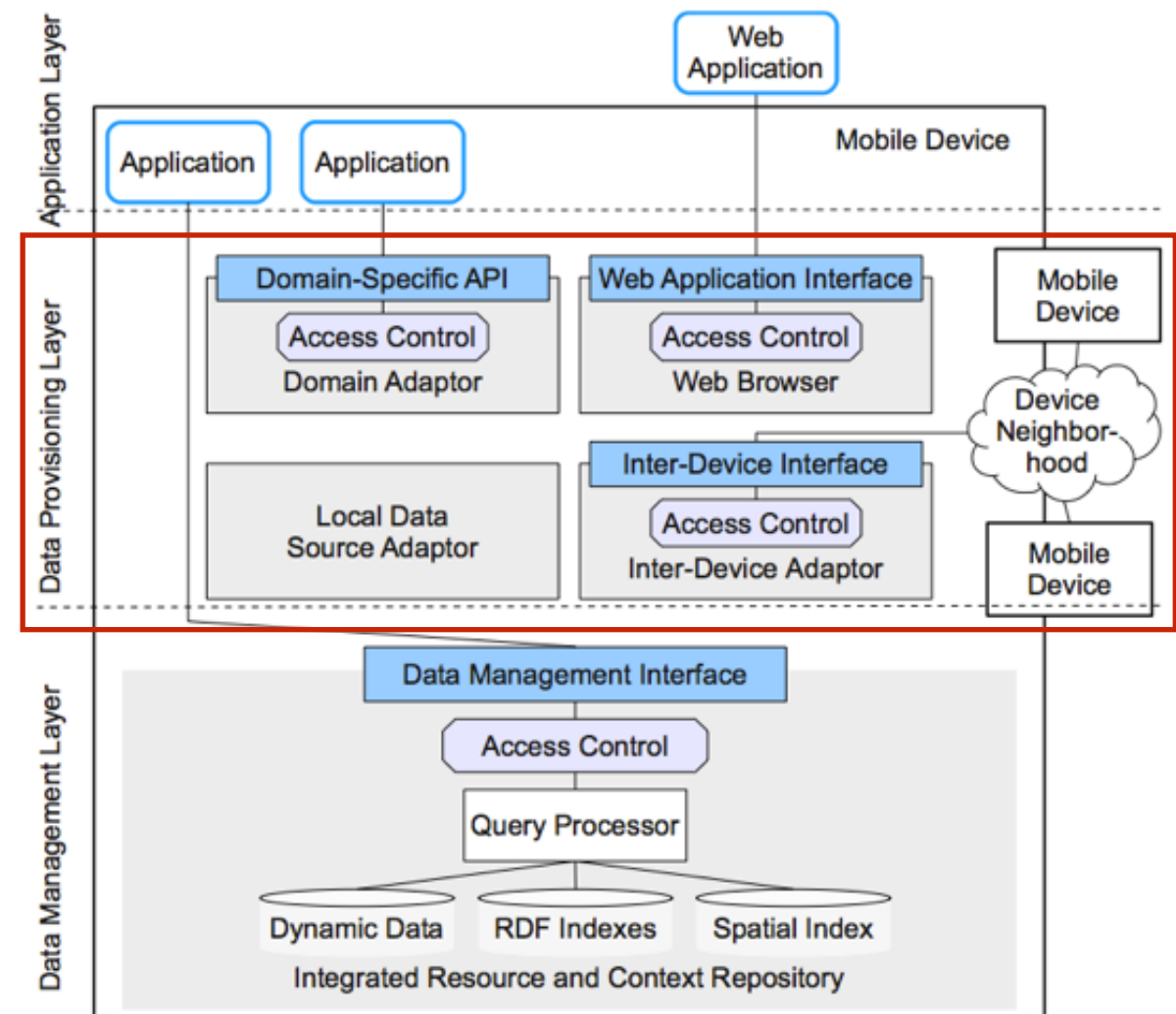 - Storage on device. HTML5 webstorage

Architecture
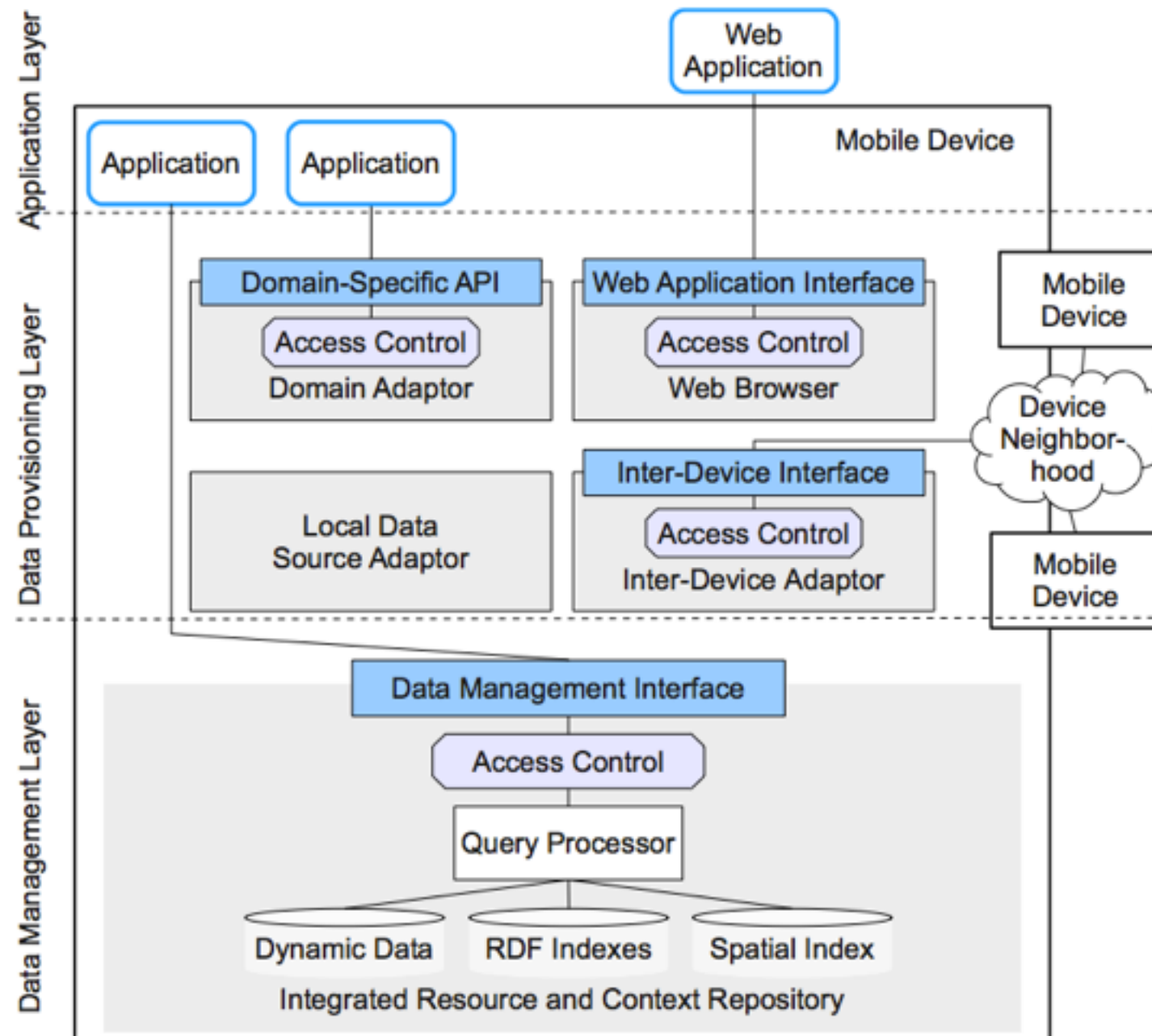
Application Layer

- Incorporates all applications

- Web interface abolishes separation with Local

- Consume data from bottom layers
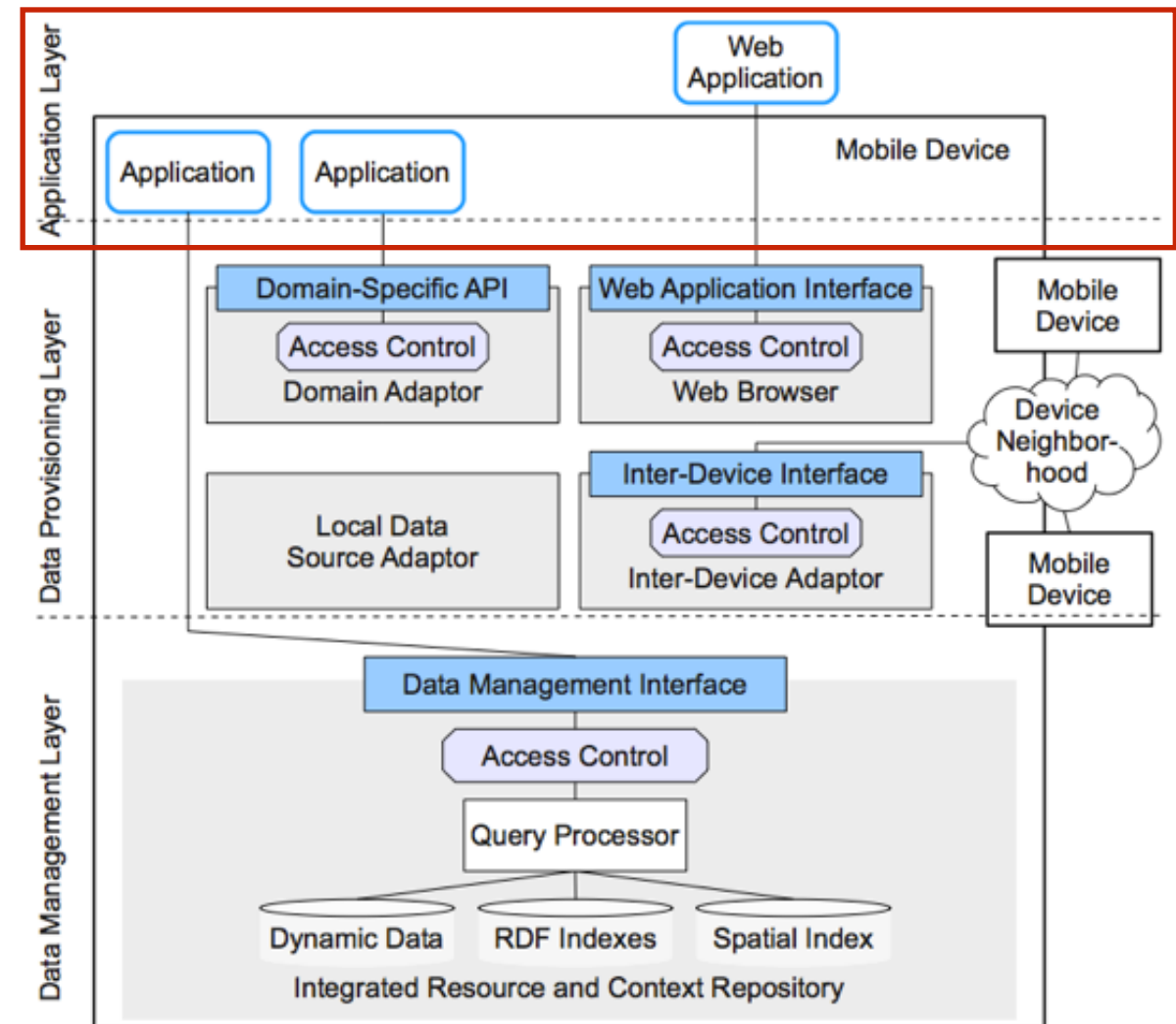
Data Provisioning Layer

- API Local data sources

  - GPS, Camera

- Adaptors are vendor provided

  - Considered trusted

- Inter-device Interface

  - Communicates with neighboring devices

Data Management Layer

- Hosts the Integrated Resource and Context Repository

- Provides interoperability at data level

- Data Management Interface

  - accepts SPARQL query

  - event-based interaction for dynamic data

  - binary interaction mode for adaptors
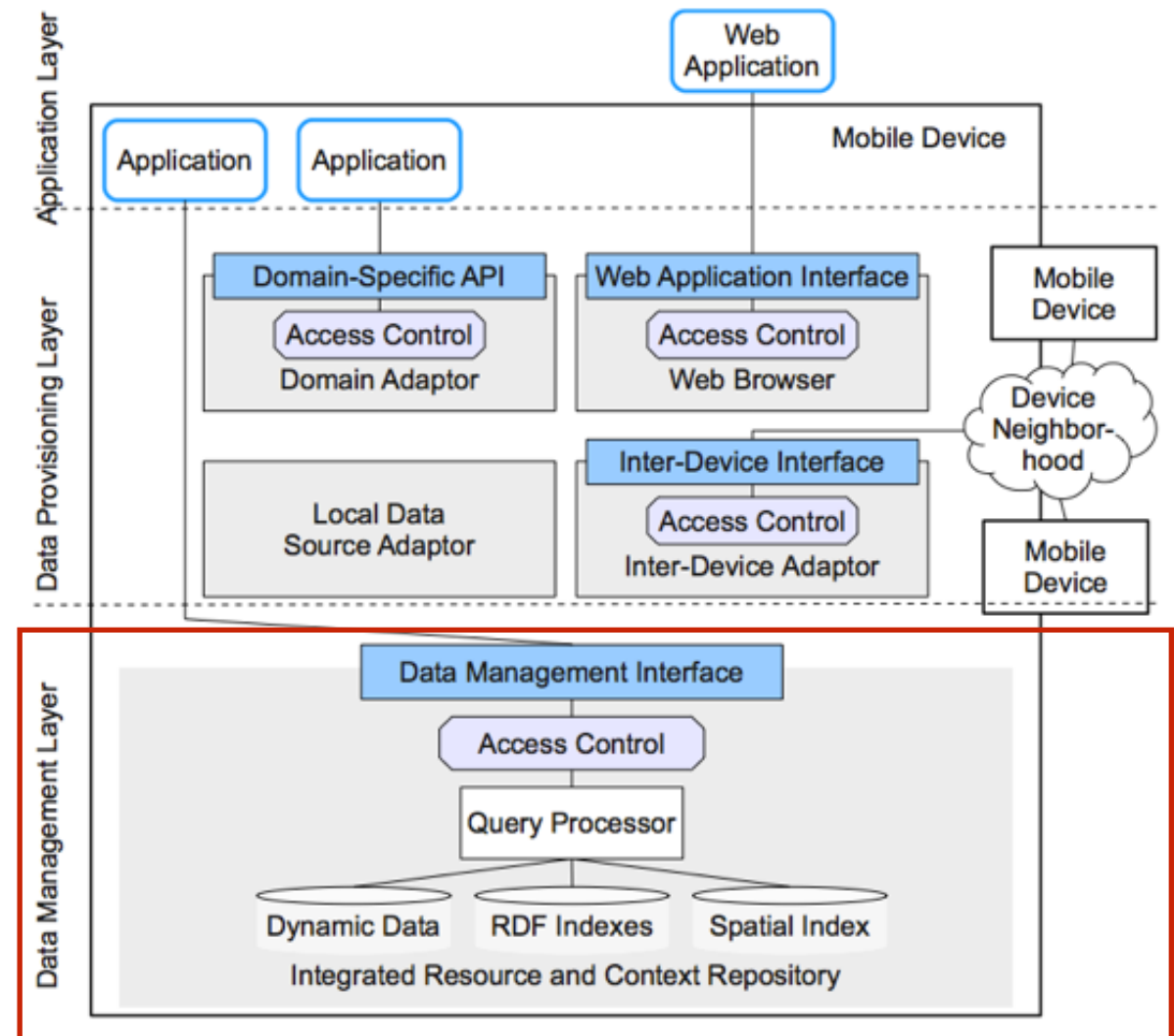
Data Model

- For interoperability model must have some properties

  - Flexibility

    - application specific to generic

  - Linkage

    - applications can relate resources

  - Spatial Data

    - data should be annotated with data

- RDF used as data model

RDF

- Resource Description Framework

  - w3c standard for metadata exchange

- Supports *relations* as first-class objects

  - *(subject, predicate, object)* - triples

- Covers metadata level

  - resources grouped by "class"
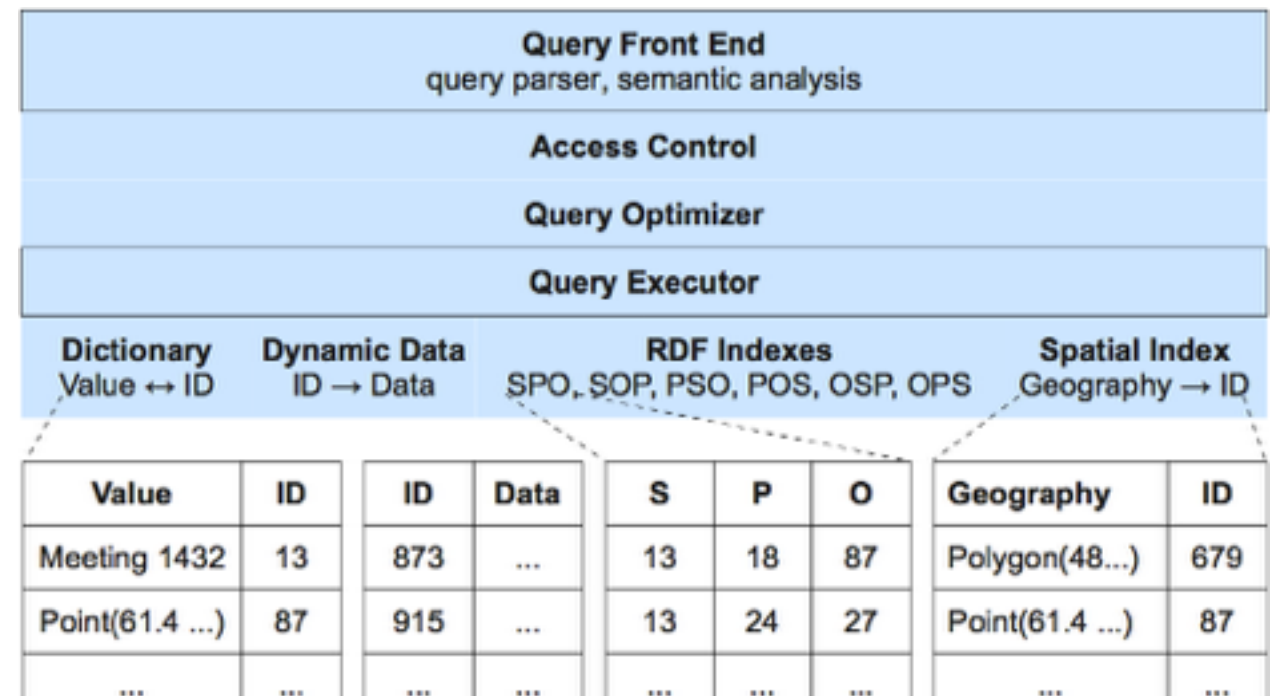
  - some standard, others defined
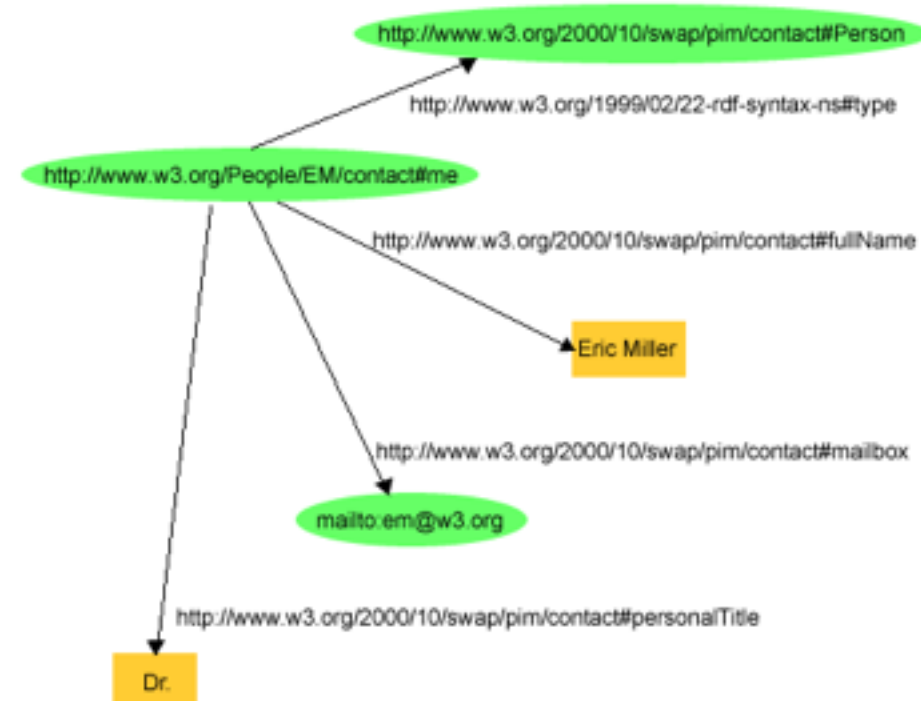
Access Control

- RBAC model

  - granularity by class, properties, or resources

  - group them hierarchically

- Application prompted on install

  - holds the right forever

  - Web application lose theirs after a period

- Access rights checked on query

  - rights joined with results

  - domain adaptor queries not checked

Resource Repository

- Integrated Resource and Context Repository

- Extends RDF to RDF-3X

  - maps literals to index in memory

  - appends location information

Query Front End
query parser, semantic analysis

Access Control

Query Optimizer

Query Executor

Dictionary Value ↔ ID	Dynamic Data ID → Data	RDF Indexes SPO, SOP, PSO, POS, OSP, OPS	Spatial Index Geography → ID

| Value	ID	ID	Data	S	P	O	Geography	ID
Meeting 1432	13	873	...	13	18	87	Polygon(48...)	679
Point(61.4 ...)	87	915	...	13	24	27	Point(61.4 ...)	87
...	...	...	...	...	...	...	...	...

Conclusion

- Evaluation

  - 100 RDF classes, 200 access roles, 300 apps, Nokia N900

  - Queries executed in 0.01 to 0.18

- **Positives**

  - Some feasibility

- **Negatives**

  - Old phone, Old OS (Maemo)

  - Little detail

  - None on inter-device interaction

Diabetes Assistant

- Patient-centered care

  - Productive life

  - Suited for patients in need of continuous monitoring

- User-centered solutions

  - Context-aware applications

  - Transforming information into knowledge

- Exploiting mobile sensors

  - Using location to curate care

Architecture

- Server-client architecture

- Backend

  - Get client information, process and provides feedback

  - Performs computations

- Frontend

  - Made of several internal modules

  - Communication module sends data to server

    - provides API for mobile app
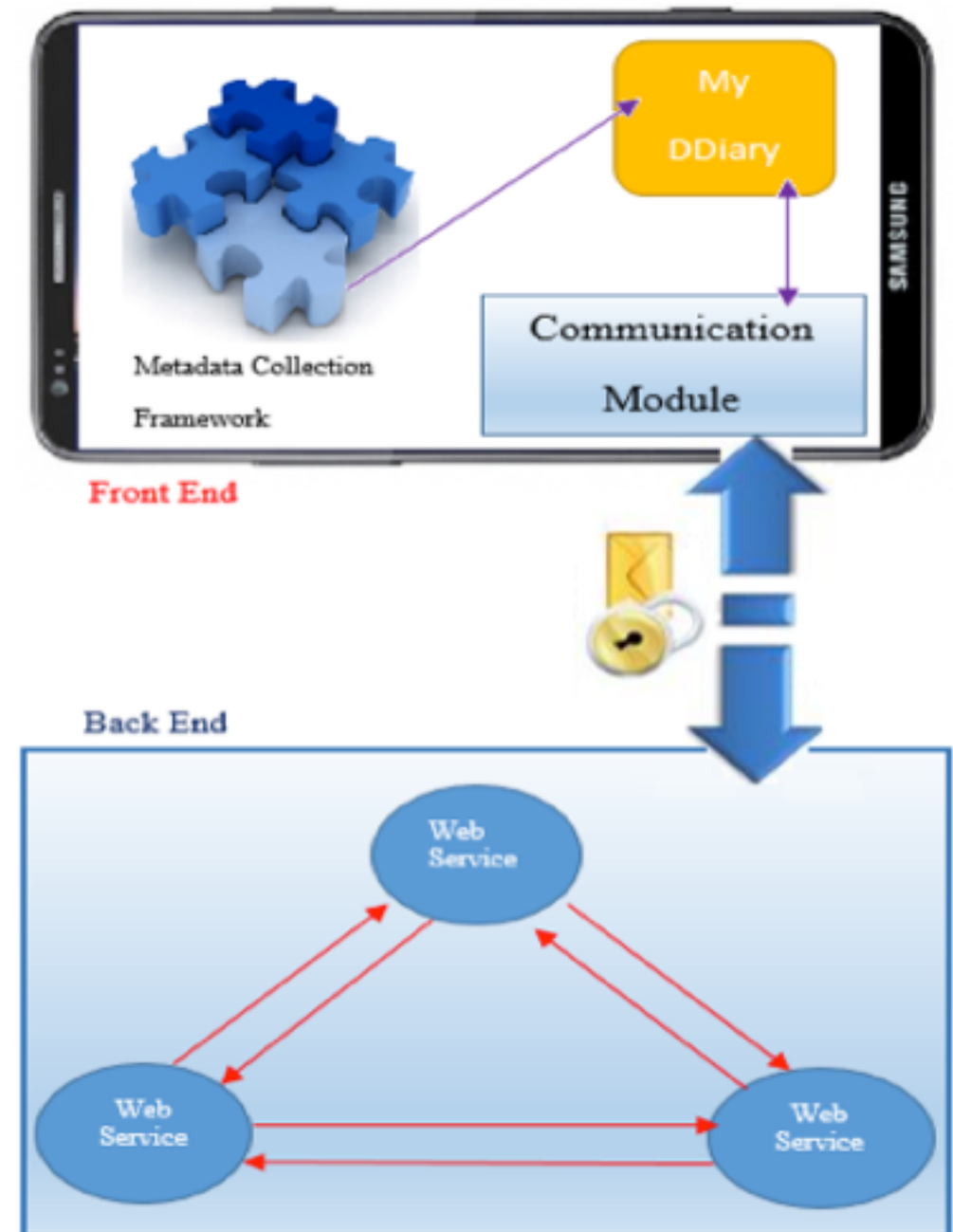
Metadata module

- Only metadata is stored

  - "how long was the call with Jill"

- Scans and classifies data from data sources

  - translates SQL like queries to internal representation

  - placeholders for time and space

    - allows filtering

myDDiary

- Application that allows diabetes management

- Extensible by design

  - additional data sources could be added

- Automation of repetitive tasks

  - For example "Gym from 7 to 8pm all week"

    - check time and location of user

- Automation of tedious tasks

  - Instead of food calories, snap picture of plate

Conclusion

- Allows patient to manage their diabetes

- Patient has fine-grained control over data

  - location sharing at specific instances

- Converting complex data with spatial attributes

- Future work

  - User evaluation

  - Crowdsourcing possibilities

Thank You