

Semantic Web Technologies II

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Semantic Cloud Management

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fluid Operations

- Mission Statement

- solving today's complex **cloud computing** challenges with truly innovative technologies:
- virtualization, cloud-based management, Web 2.0 and semantic technologies

- Key data

- Growing startup with a spirited team
- Offices in the SAP Partner Port Walldorf
- Some of the largest IT companies as customers or development partners
- <http://www.fluidops.com/>



Agenda

- Cloud Computing
 - Overview
 - Challenges related to semantics
- Semantic Technologies for Cloud Management
 - Information integration
 - Wiki-based documentation collaboration
 - Intelligent user interfaces
- Demo Information Workbench
- Open Research Topics

Cloud Computing

- Web based
- Virtualized
- On-demand
- Easy to use
- Scalable
- Pay as you go

Software as a Service



Platform as a Service



Infrastructure as a Service



Alexander Lenk, Thomas Sandholm, Markus Klems, Jens Nimis, Stefan Tai

[What's Inside the Cloud? An Architectural Map of the Cloud Landscape](#)

Workshop on Software Engineering Challenges in Cloud Computing @ ICSE 2009

fluid Operations @ SAP

- SAP Center of Excellence
 - ~ 800 Proof of Concept projects /year
 - Project = Management of an SAP landscape over the Internet
 - Project duration: between 2 weeks and 1 year
- Hardware



6 NetApp Filer



250 Blades



110 IWDF



2 HP EVA



IBM P6

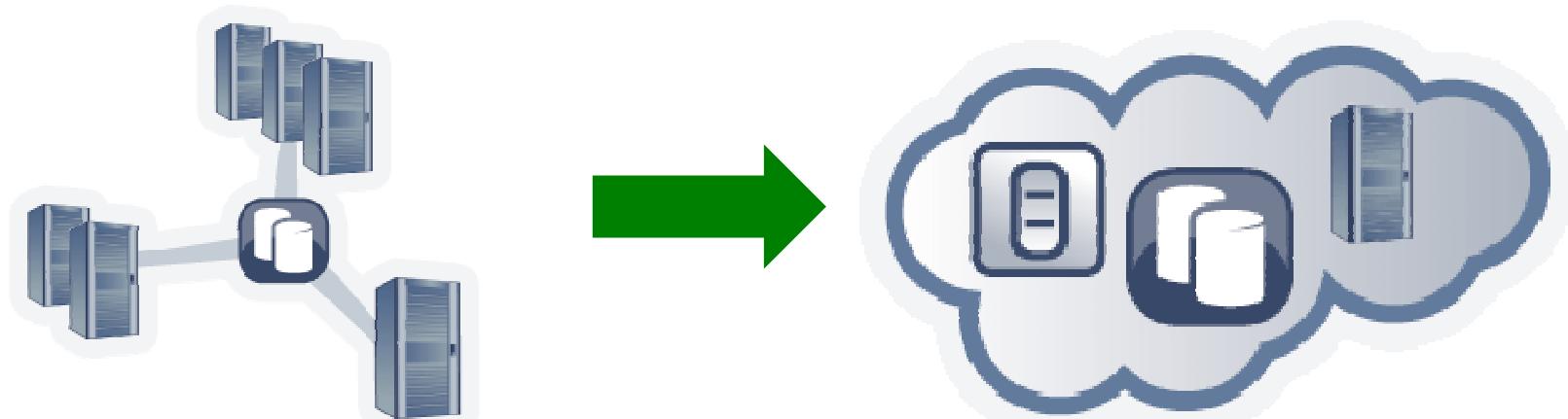


HP Superdome

- *What if you could provision a complete SAP landscape in 10 minutes?*
- *What if that landscape were already pre-seeded with all relevant application content?*
- Compare ...
 - 8 weeks average for the same at SAP customer sites, 4 within SAP
 - 1 week to resurrect a (successful) test landscape
 - 15 min for an empty WinOS with Amazon EC2

Enterprise Clouds – *eCloud* Vision

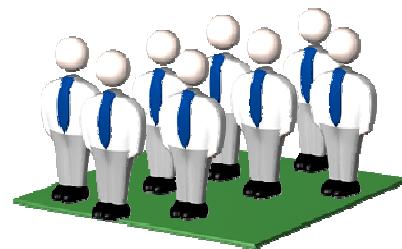
- All resources of an ***adaptive, cloud-enabled*** IT environment can be ***set up, monitored, and maintained*** from a ***single, unified, and intuitive management console***:
 - Internal and external IT resources accessible across stack without vendor lock-in
 - High degree of automation and IT provisioning at click of button on the level of enterprise landscapes
 - Internal portal of private/public IT services with e.g. pay-as-you-go cost models



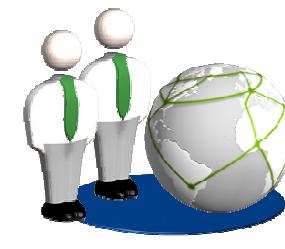
Manage IT like an eCloud



IT admins



Application customers



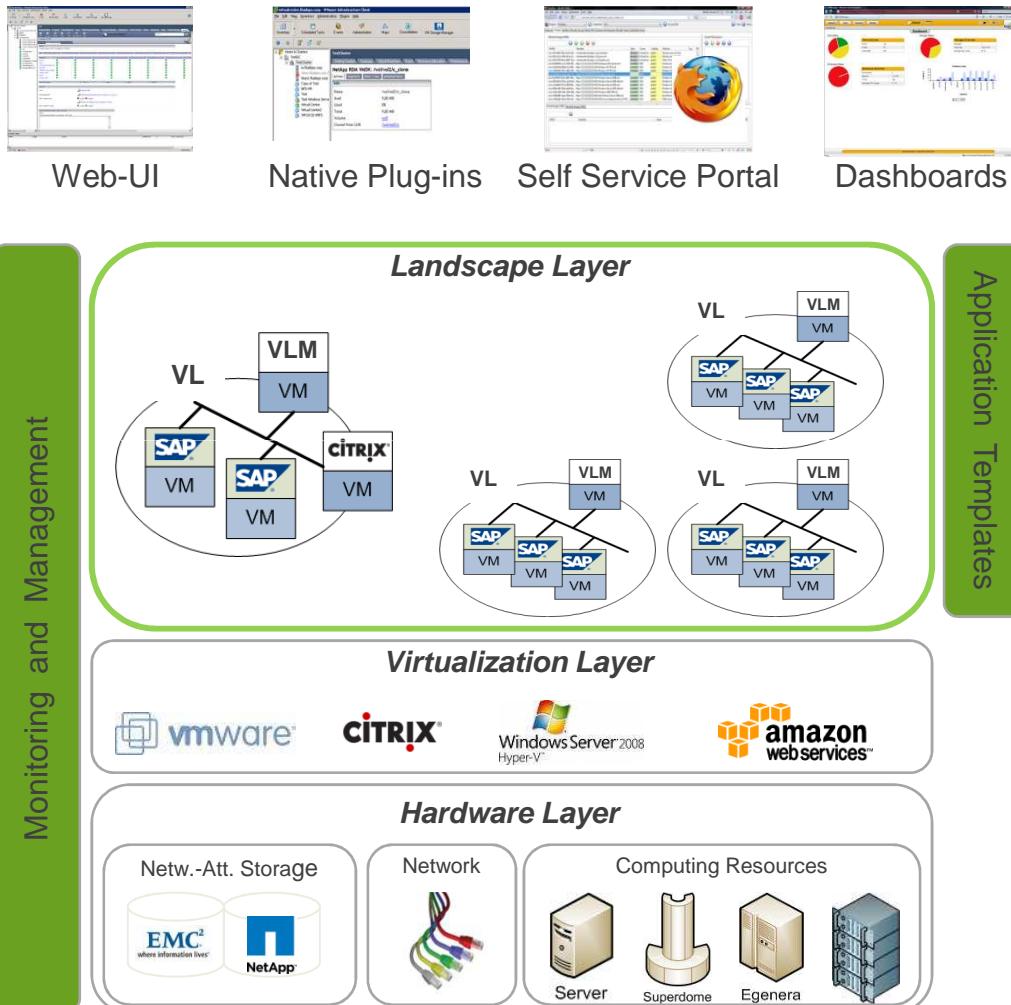
CXOs



fluidOps:
stack virtualization
and *semantic integration* as
foundational
capabilities for
efficient automation



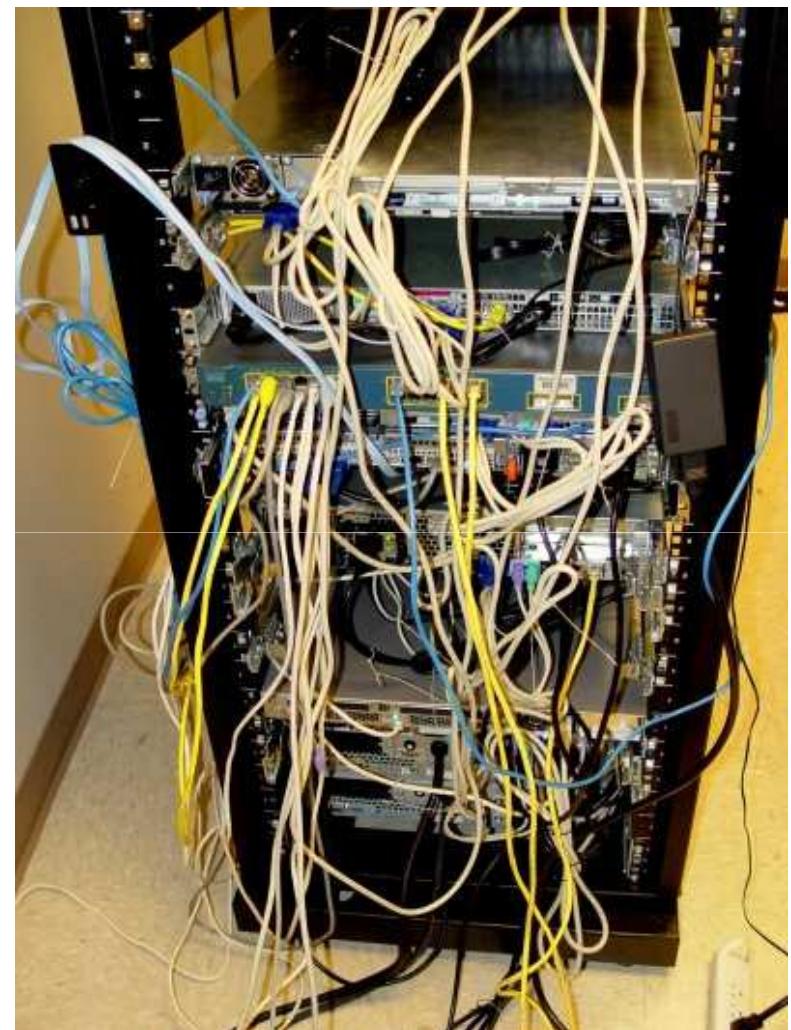
eCloud - Solution View



- **Business layer**
 - Admin, business client & business sponsor cockpits
 - Integrated monitoring and system management along the entire stack
 - Landscape-level provisioning with unique application template support & automated cloning
 - Unprecedented application development, testing and production productivity
- **Infrastructure layer**
 - Open platform for heterogeneous systems
 - Lower TCO via optimized HW utilization and maintenance automation
 - Flexibility of scaling up or down
 - Security and reliability

Challenge: Automation

- Automation
 - “as a Service” environments are always dynamic
- Virtualisation
 - Do we change the wires physically or virtually?



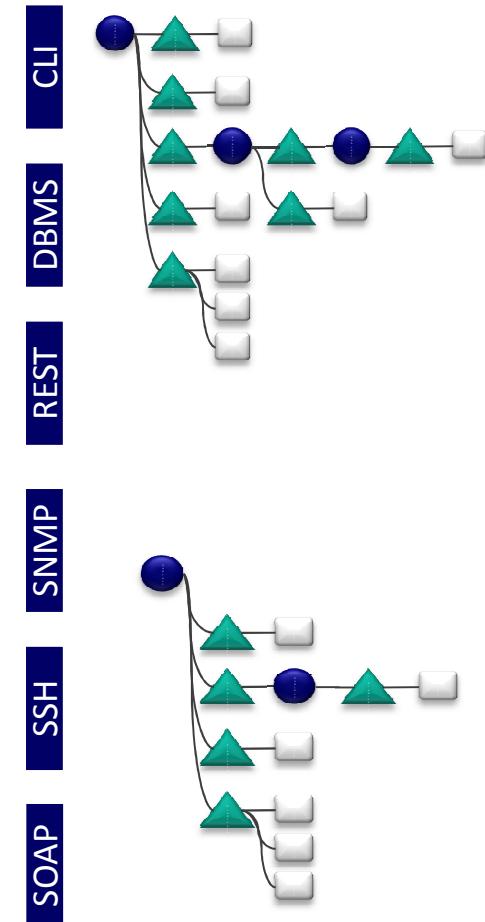
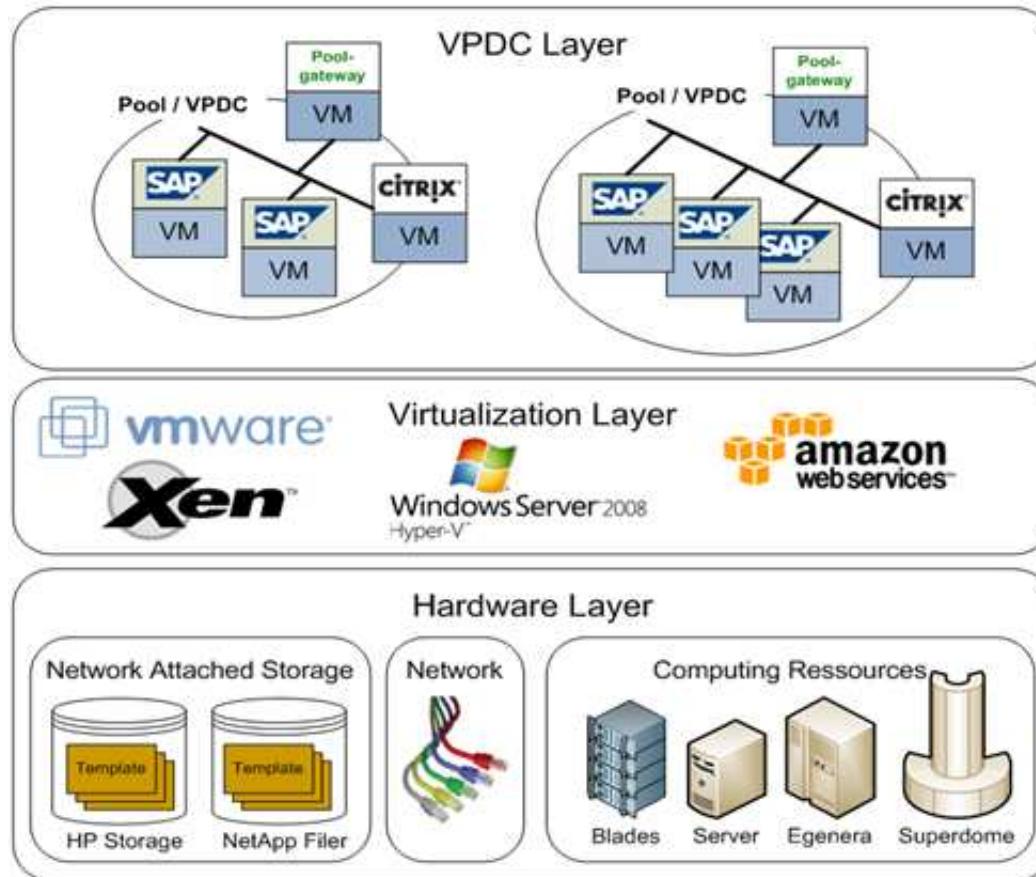
Prerequisite for Automation

- Orchestration of all layer
 - CPU, Storage, Network, Application
- Integration of interfaces
 - Data, Services

Cloud Infrastructure Management



Semantic Integration for Cloud Management



Documentation using Wikis

FF Rack3 usage - BTeam - Windows Internet Explorer
http://iwd9593.wdf.sap.corp:1080/wiki/index.php/FF_Rack3_usage

FF Rack3 usage - BTeam

Netweaver - Platforms Center of Excellence SAP

article discussion edit history move watch C5027387 my talk my preferences my watchlist my contributions log out

projects zone

- Projects on FF1
- Projects on FF2
- Projects on FF3
- Projects on IWDF Servers
- Projects on IBM
- Projects on HP
- Projects on ESX Vmware
- Projects on Egenera
- BI Lab
- Projects - closed/frozen

bteam navigation

- Infrastructure
- System monitoring
- Theory
- Internal
- Vendor documentation
- Site map
- Contacts
- FAQ

knowledge zone

- Administrative
- FlexFrame
- Citrix
- Filer/NetApp
- ESX VMWare
- VMWare
- XEN
- Scripts
- Access/Connection
- Howto template

links

FF Rack3 usage

Please use this PROJECT_TEMPLATE

You can always check the Project documentation pages.

See also : Project Specific config

- Blade usage

Project Pools on Rack3

Content

1 Project Pools on Rack3

- 1.1 THESE ARE ALL FREE AN's
- 1.2 FROZEN VOLUMES ON FILE
- 1.3 P301: Administration only
- 1.4 P302: Template System
- 1.5 P303: IDES Templates
- 1.6 P304: MCA
- 1.7 P305: AT&T CPT
- 1.8 P306: CRM Demo Landscape
- 1.9 P307: WINDOWS
- 1.10 P308: template pool NEW
- 1.11 P309: Retail 2
- 1.12 P310: Multiclient Engine
- 1.13 P311: MOM
- 1.14 P312: PS&P Banking Land
- 1.15 P313: Discovery Lab
- 1.16 P314: template pool mirror
- 1.17 P315: FREE

XEN

Overview

- Connecting Management Blade Xer... rm over RDP IP: 10.17.1.76 User: bteam, Passw. c....
- Manage FSC BM600 BladeCenter over ... http://10.17.129.7.108... User: root, Passw. v... root
- For manage FSC Switch Blades connect Management Blade for Xen Fa... and open UR...
 - http://10.20.10.250:1080/FSC/middle.html for S... Switch Blade 1 User: root, Passw. n... root
 - http://10.20.10.251:1080/FSC/middle.html for S... Switch Blade 2 User: root, Passw. n... root
- For manage Netapp filer21 use URL http://10.20.20.114:21 User: na_admin, User: root, Passw. n... root

XEN Landscape

- Blade1 MGXEN User: bteam, Passw.: c...
 - BigLan 172.19.138.100
 - BackupLan 172.17.225.100
 - ClientLan 10.20.1.1
 - ClientLan 10.20.2.1
 - ConsoleLan 10.17.1.76
- Blade2 Xenserver1 User: root, Passw.: s...
 - BigLan 172.17.38.101
 - BackupLan 172.17.225.101
 - ClientLan 10.20.2.21
- VM ADS
 - ClientLan 10.20.10.100
 - PoolLanLan 10.20.1.10
- VM WiFi
 - ClientLan 10.20.1.10
 - poolLan 10.112.35

Done

Local intranet 100% 100% 100%

KIT – die Kooperation von Forschungszentrum Karlsruhe und Universität Karlsruhe (TH)

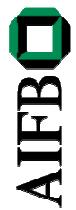
Forschungsuniversität • gegründet 1825

Documentation using Wikis

■ Problems

- Dynamic Data (e.g. IP addresses) need to be entered redundantly
- Users need to use multiple, isolated applications
- Lack of structure and semantics

Challenge: Intelligent User Interfaces



- Personalization and views on the data according to preferences and user roles
- Actionable information: Ability to interact with the data
 - E.g. Logging onto a server, starting a VM, cloning a system
 - Calling a person, notification via email, ...

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Semantic Technologies for Cloud Management

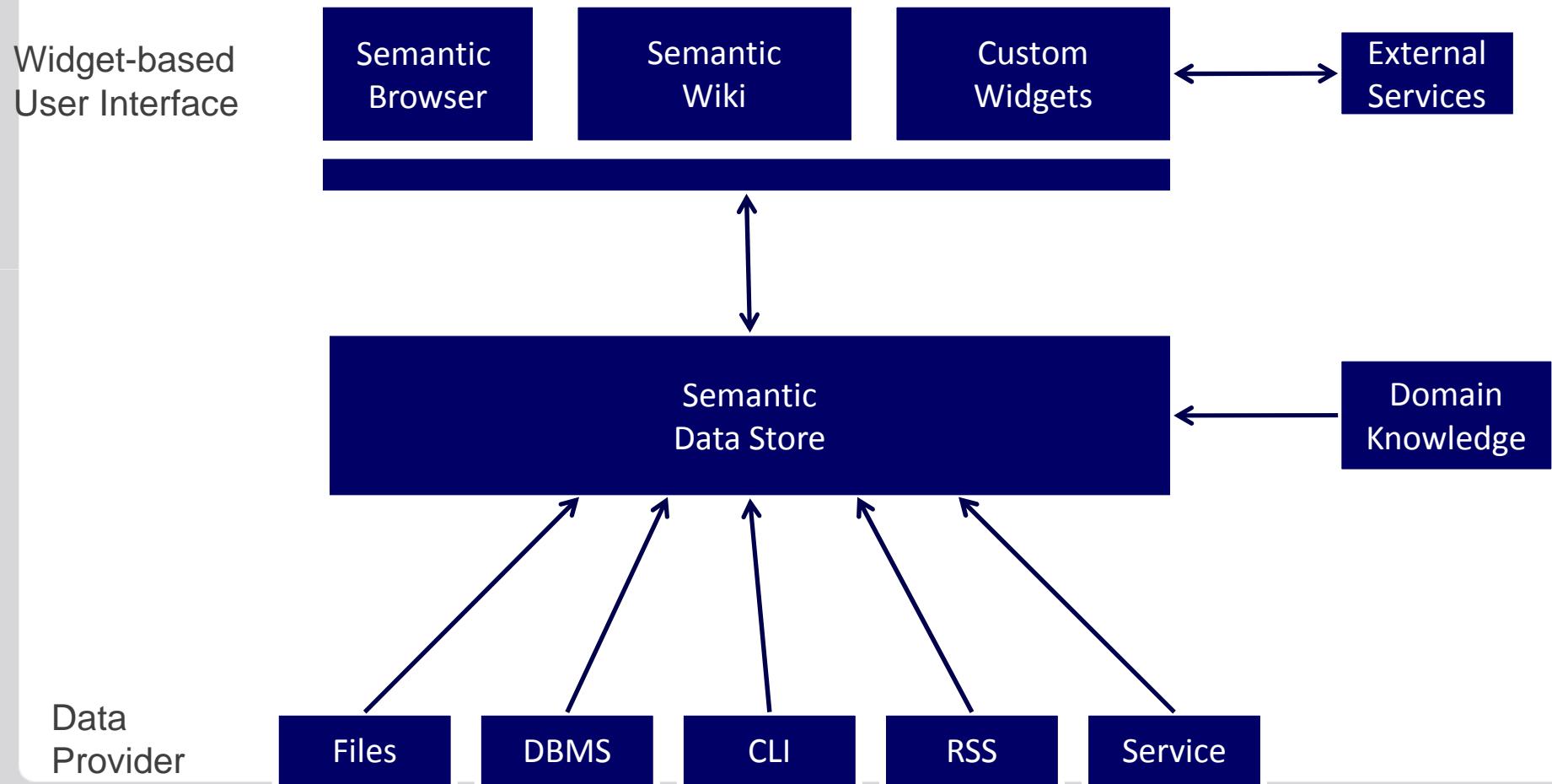


- Sample Application: Information Workbench
 - Collaborative data processing and annotation engine
- Uses of semantic technologies
 - Import and integrate live data from heterogeneous sources, semantic search across data sources
 - Annotation, documentation, collaboration
 - Semantic Wiki technology
 - Visualization driven by semantics
 - Customizable UI widgets
 - Web 3.0 mashup features

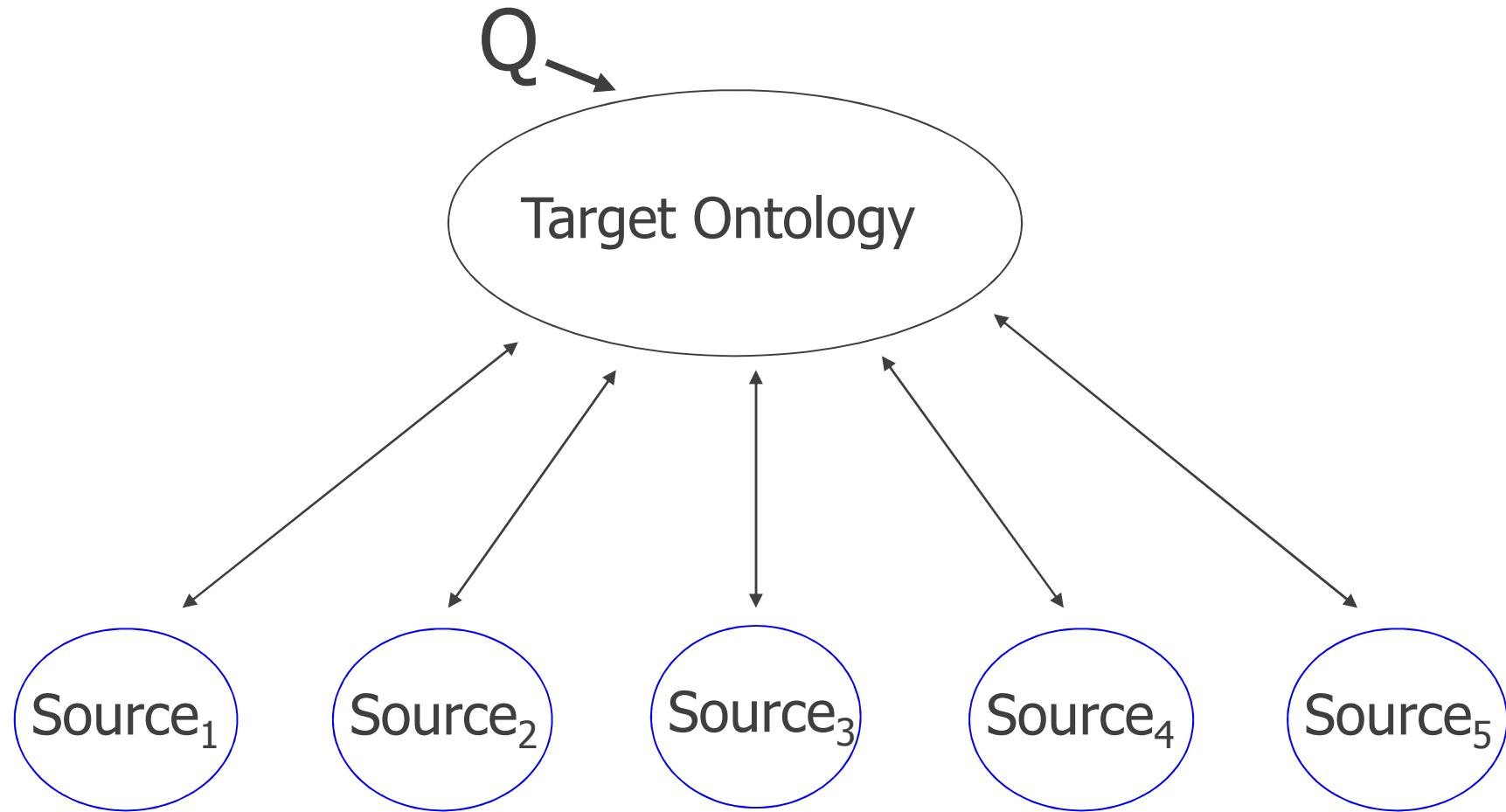
Example: Cloud Management at the SAP Center of Excellence

- Integration of data from diverse sources
 - User information
 - Infrastructure
 - SAP landscapes
 - Project databases
- Wiki-based collaborative annotations
 - Documentation tightly integrated with live data
 - No separate wiki needed
 - Avoiding redundancy of information
- Actionable information
 - E.g. logging onto a server, cloning an SAP system

Information Workbench - Architecture



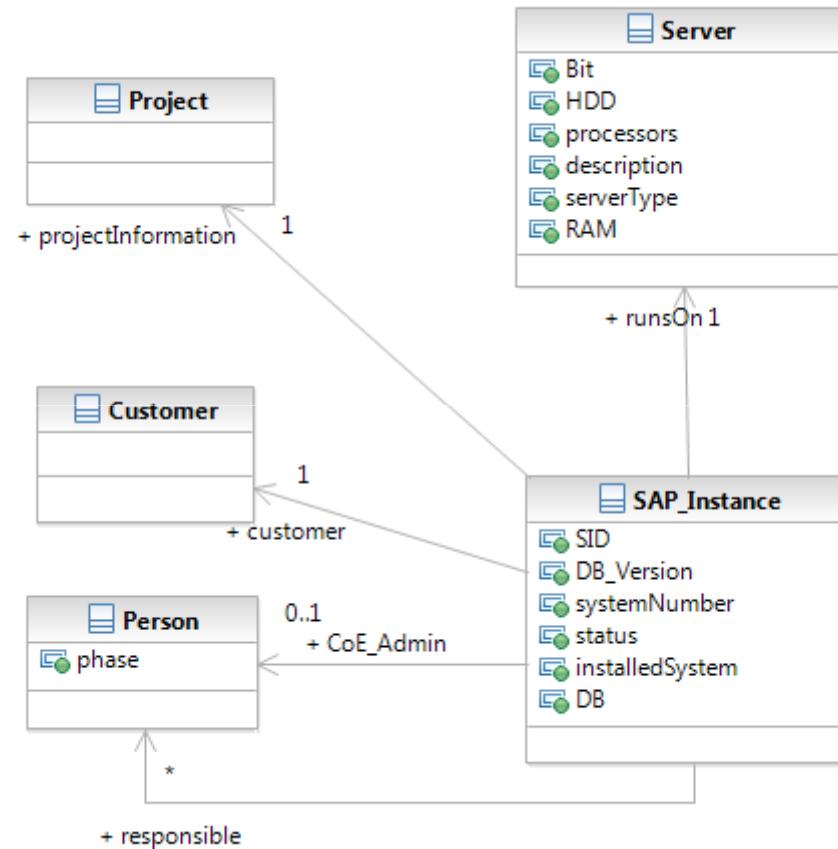
Ontology-based Information Integration



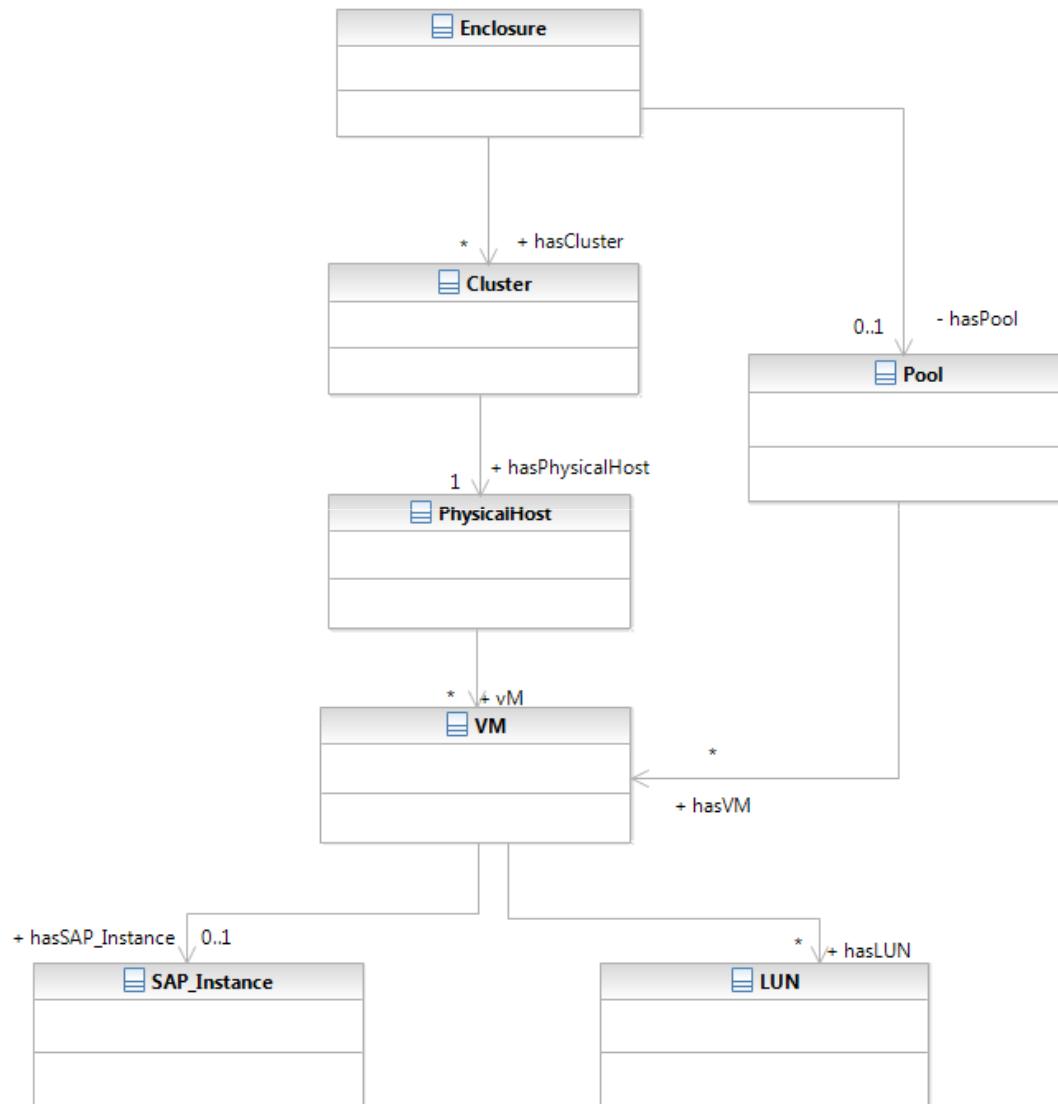
Modeling Data Sources using Ontologies

1. Reverse Engineering of data sources using domain knowledge
 2. Definition of mapping of the source data model to the ontology
 3. Population of the target ontology from the source instance data
 - One-time extraction for static data
 - Using caching and regular updates
 - Or runtime/online access for dynamic data sources
-
- Typical Problems:
 - Non-normalized sources
 - Imperfect data:
 - Syntactic heterogeneity (no keys)
 - Missing information
 - Obsolete information

Sample Ontology for a Data Source

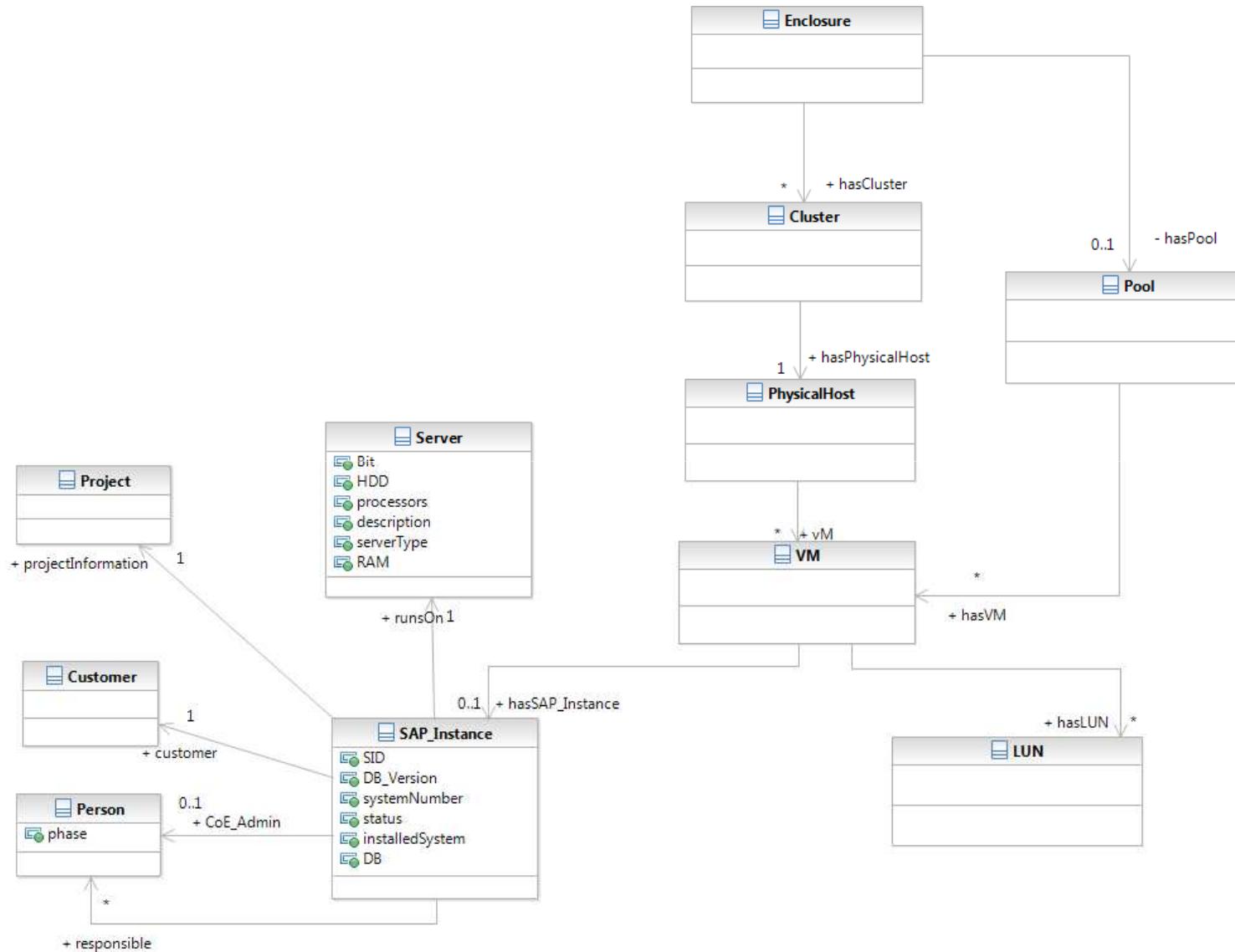


Cloud Management Ontology: Landscapes



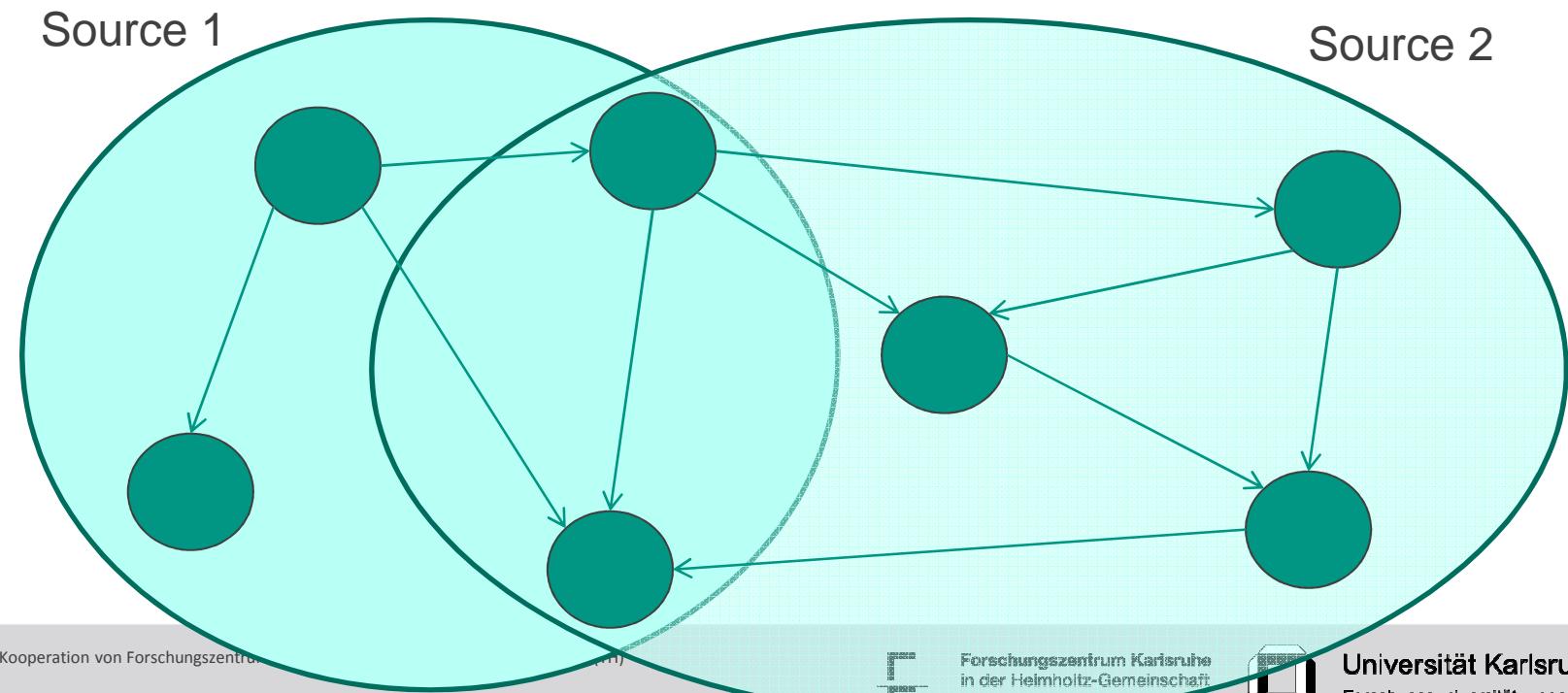
- Integration of data from different APIs (Providers)

Integrated Ontology (Fragment)



Managing Provenance of the Data

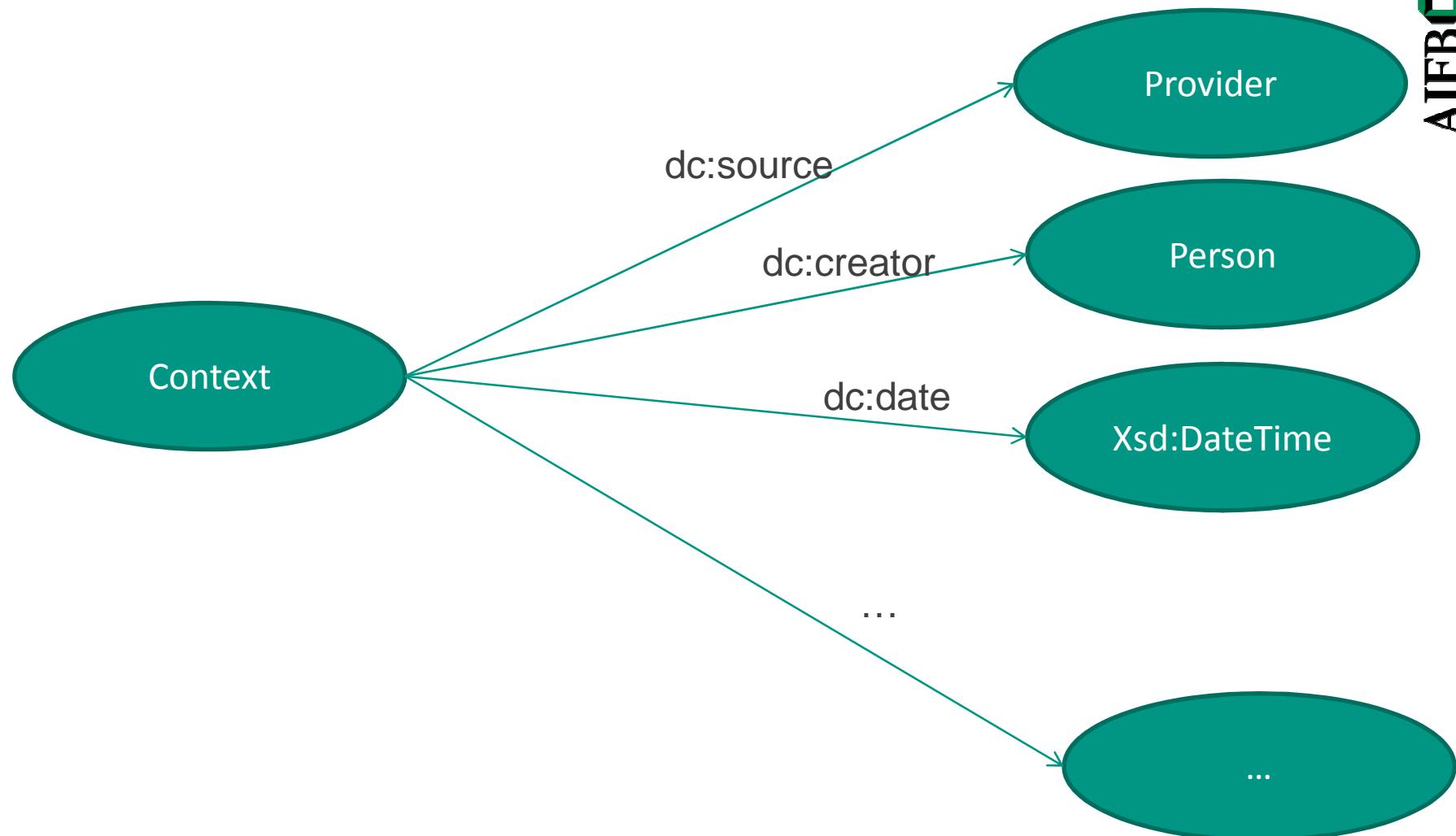
- Need to manage metadata about the origin of the data: where it comes from, when it was created, ...
- Contexts can be used to group sets of statements that logically belong together, for example because they come from the same source



RDF Data and Contexts

- Quadruples instead of triples
- (subject, predicate, object, context)
- Context is just another resource about which additional statements can be made

Using Context to Express Provenance



Demo

Content: 'iwdf1081'

phaase Edit Widgets...

Wiki for *iwdf1081*

View Blog Edit Revisions

(No text defined for this topic)

Graph for Subject *iwdf1081*

```
graph LR; LNC((LNC)) -- runsOn --> iwdf1081((iwdf1081)); TSD((TSD)) -- runsOn --> iwdf1081; iwdf1081 -- "HDD: 406" --> HDD((HDD)); iwdf1081 -- "MHz: 3400" --> MHz((MHz)); iwdf1081 -- "processors: 4" --> processors((processors)); iwdf1081 -- "RAM: 8" --> RAM((RAM)); iwdf1081 -- "serverType: ProLiant DL380 G4" --> serverType((serverType)); iwdf1081 -- "type: Server" --> type((type));
```

Add new Facts to *iwdf1081*

Define a new RDF statement Upload a document

Predicate: Durchsuchen...

Object: Select document to upload

Add

Outgoing Statements from *iwdf1081*

serverType	ProLiant DL380 G4
HDD	406
RAM	8
type	Server
processors	4
MHz	3400

Incoming Statements to *iwdf1081*

Incoming Statements to *iwdf1081*

runsOn LNC TSD

Facts from this Provider

Facts provided by this model

DataSources *iwdf1081*

systemsSAP.groovy
systemsHW.groovy

Semantic Wikis: From unstructured to structured content



- Wikis are well-established tool for annotation and documentation
- Do not enforce schema and structure up-front
- Semantic annotations allow seamless introduction of structure and semantics in an iterative manner

Intelligent User Interfaces: Widgets for Semantic Data

- Situation:
 - Either no schema available, or schema dynamically changing
- Idea:
 - Every widget is able to **display certain properties** of an entity
 - Widgets are **selected based on the properties** of an entity (types of triples)
 - Widgets can dynamically integrate **external data sources**
 - Widgets may allow for different types of **interaction**

Demo: Part 3

Content: 'TATA'

haase Edit Widgets...

Wiki for TATA

View Blog Edit Revisions

Tata is located in Mumbai

Graph for Subject TATA

default

```
graph LR; iwdf0401 -- "reserved for" --> TATA; LNC -- "customer" --> TATA; TSD -- "customer" --> TATA; TATA -- "location" --> Mumbai; TATA -- "page" --> Tatai; TATA -- "youTubeID" --> 3sZitve3SUw; TATA -- "logo" --> 451px-tata_logo.png
```

Outgoing Statements from TATA

Outgoing Statements from TATA
youTubeID 3sZitve3SUw
logo 451px-tata_logo.png
location Mumbai
page Tata is located in [[location::Mumbai]]

Add new Facts to TATA

Define a new RDF statement

Predicate:

Object:

Upload a document

Durchsuchen...

Select document to upload

Image TATA



YouTube TATA

Tata Nano driven by Autocar.co.uk



GMap TATA



Summary

- Challenges in Cloud Management
 - Heterogeneous data sources covering technical and business aspects
 - Integration of structured data and unstructured annotations required
 - Loose and dynamic schemas
- Semantic Technologies for Cloud Management
 - Ontologies enable flexible information integration
 - Semantic wikis allow for (semi)-structured collaborative annotations
 - Widgets for semantic data allow for intelligent user interfaces

Program for students: fluid experience



- Internships / Working Students
 - Gain practical experience with cutting edge technologies
 - Professional working environment
 - Close interaction with the development and management staff
 - Attractive compensation
 - Flexible start dates and durations
 - Gourmet cafeteria, free soft drinks
- Thesis Students (Bachelor, Masters, Diplom)
 - Challenging research topics with practical relevance
 - Top class supervision and sponsorship of theses
 - Excellent chances for transfer of results into innovative products

fluid experience – Hot Topics

Project topic	
1	Scalable semantic data management in the cloud
2	Mashups and information integration in cloud-based environments
3	Managing internal IT like a cloud
4	Infrastructure-as-a-Service
5	Compute, storage and network virtualization
6	Load balancing and failover management in enterprise compute clouds
	<i>... and many more!</i>

Contact us: students@fluidops.com