Service Modeling, Clouds and Networks

Jorge Cardoso

Information Systems Group

Dept. Engenharia Informatica/CISUC
University of Coimbra, Portugal
jcardoso@dei.uc.pt

University of Coimbra

Coimbra University

› 720 years old

› Tradition in Law and Medicine

› Strong in IT & Electronics, Biotech and Materials

› 23.000 Students

Fac. Science & Technology

› 8000 undergraduates

› 1000 post-graduates

› 650 teaching & research staff

Fac. Science & Technology

Department of Informatics Engineering

- Informatics Engineering
- Design e Multimedia

- MSc, MSc, PhD

New MSc in Information Systems

- Information Systems Management
- Enterprise Architecture
- Business Process Management
- Service Engineering
- Interaction Design

Textbook on Service Systems

Contents

1 — Fundamentals

Summary

This chapter provides an overview of the origins of services. Two important views are examined: services as a transformation process and services as a set of resources. The differences and complementarity between services and goods are examined. Since the development of digital services is rapidly emerging, the relationships between services, software, and ICT are framed by presenting a classification framework. The last sections present the running use cases that will be used throughout the textbook and the six perspective that will be sued to study each use case.

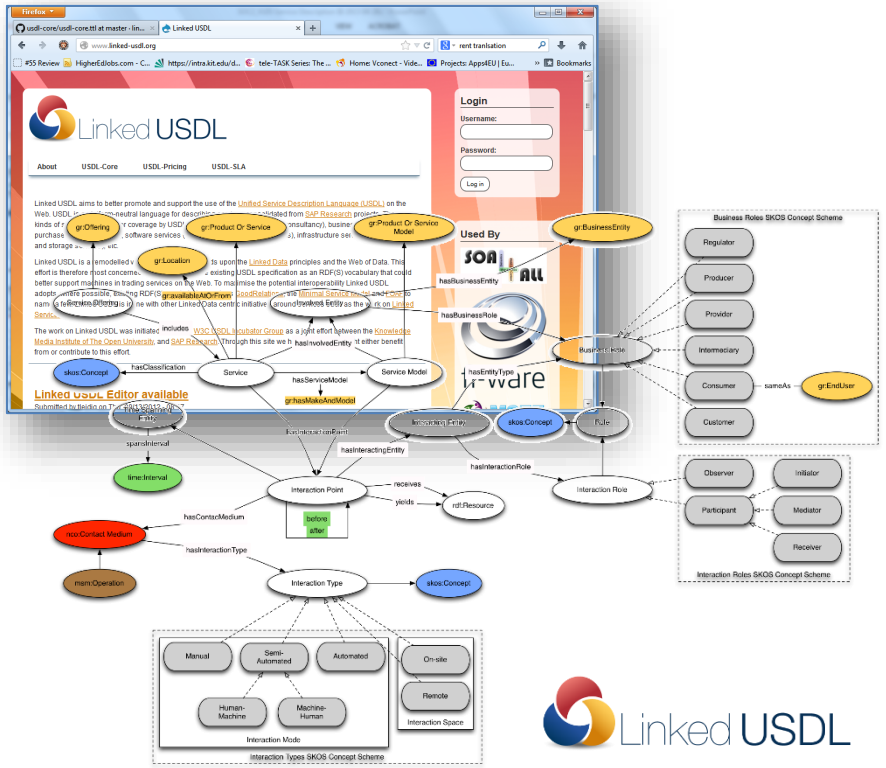
Learning Objectives

1. Understand the historical evolution of services and their importance nowadays for societies.
2. Analyse the various views on services based on the emphases placed on processes and resources.
3. Explain how services from various industry domains can benefit from a service system discipline.
4. Describe various perspectives which can be taken to study services using scientific and systematic approaches.

Linked USDL family

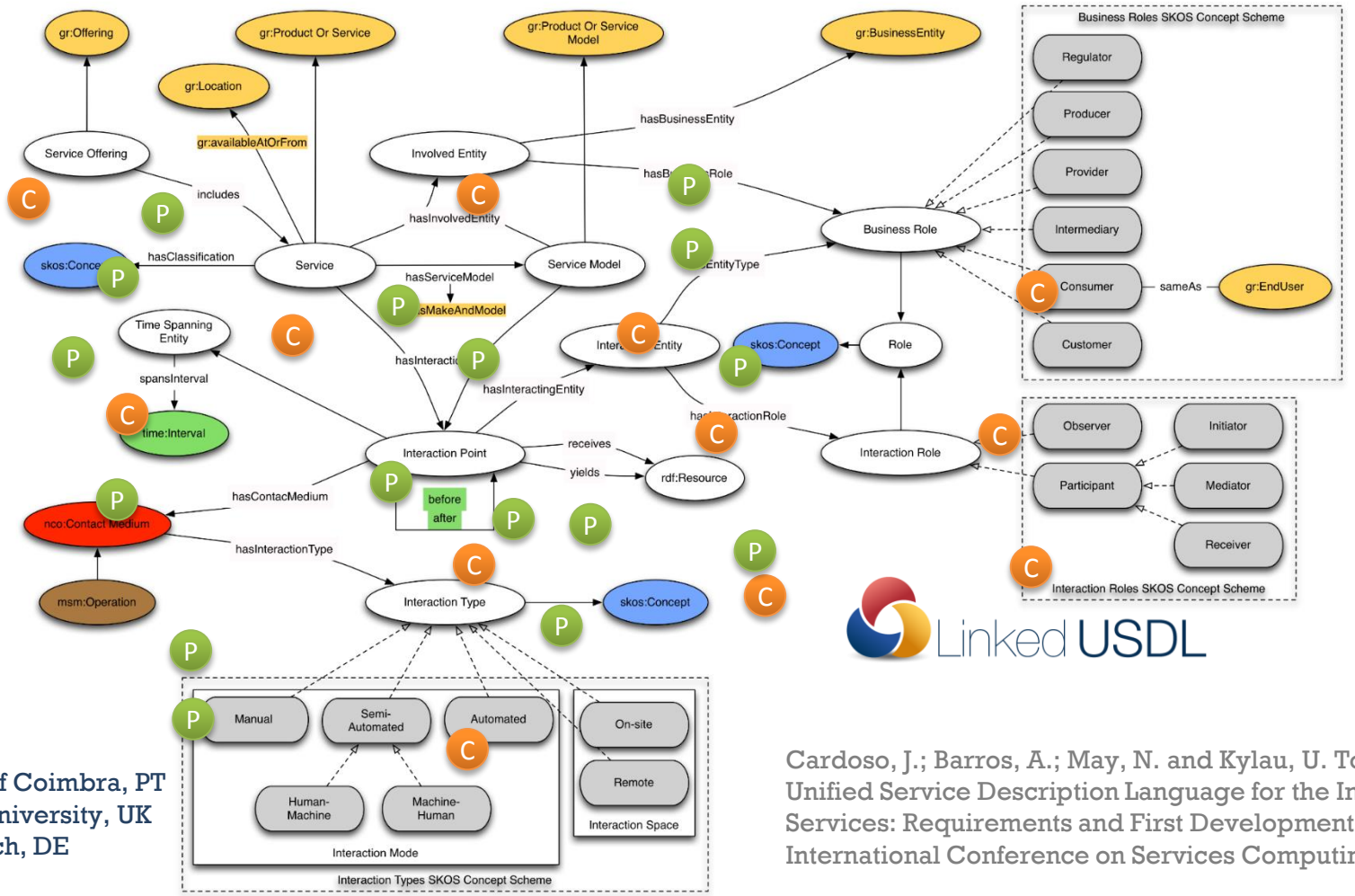
Service Description Language

- History
  - a-USDL (2009), USDL (2011), Linked USDL (2012)
- New models (2013)
  - Linked USDL core
  - Linked USDL pricing
    - The Open University, UK
    - SAP Research, DE
  - Service System
    - University of Gent, BE
  - Service Networks



https://github.com/linked-usdl/

Linked USDL Core (2013)



University of Coimbra, PT
The Open University, UK
SAP Research, DE

Cardoso, J.; Barros, A.; May, N. and Kylau, U. Towards a Unified Service Description Language for the Internet of Services: Requirements and First Developments. In IEEE International Conference on Services Computing, 2010.

USDL:INTERACTIONPOINT

- Blueprint
  - line of interaction
- E.g. face-to-face actions between employees and customers

NAME:

usdl:InteractionPoint

DESCRIPTION:

rdfs:comment """ An InteractionPoint represents an actual step in accessing and performing operations of the service. On a technical level this could translate into calling a Web Service operation.

On a professional level, it could mean that consumer and provider meet in person to exchange service parameters or resources involved in the service delivery (e.g. documents that are processed by the provider).

An InteractionPoint can be initiated by the consumer or the provider. Since InteractionPoints may take time and have an ordering with respect to other InteractionPoints, this is a subclass of TimeSpanningEntity. One can therefore express temporal relationships between InteractionPoints such as before or after. For richer expressions the time ontology constructs could be used. """@en .

SUBCLASS:

rdfs:subClassOf usdl:TimeSpanningEntity;

Linked USDL Pricing (2013)

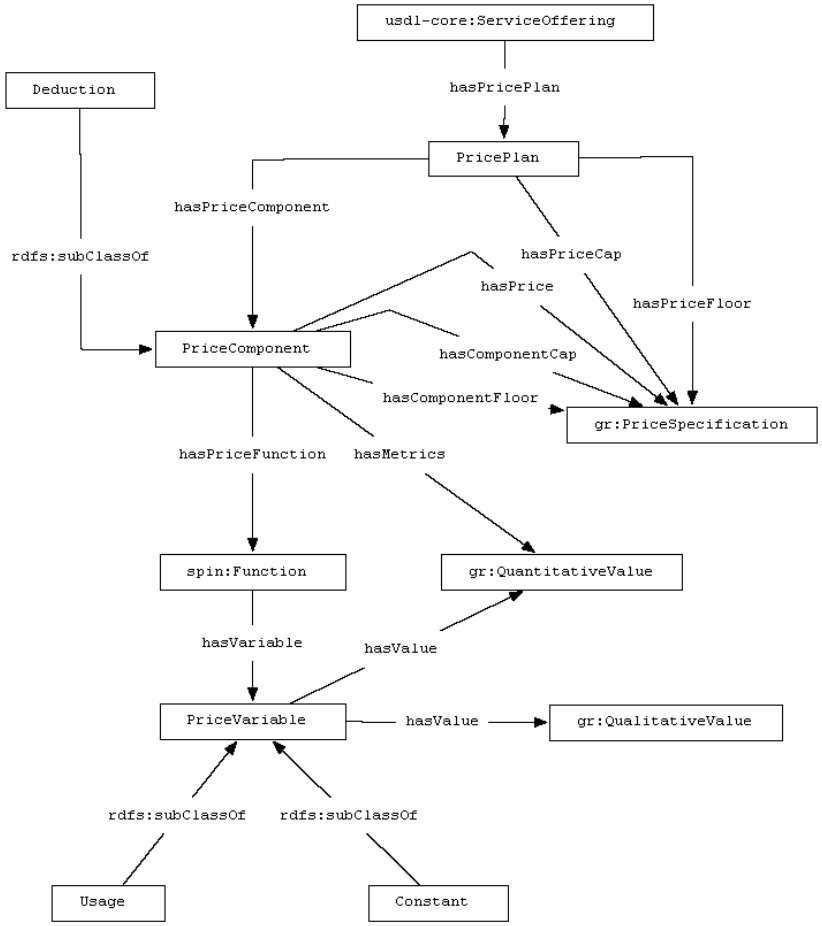
- On-Demand Instances
- Reserved Instances
- Reserved Instance Volume Discounts
- Spot Instances
- Data Transfer
- EBS-Optimized Instances
- Amazon Elastic Block Store
- Elastic IP Addresses
- Amazon CloudWatch
- Auto Scaling
- Elastic Load Balancing
- AWS GovCloud Region

Light Utilization Reserved Instances

Region: US East (N. Virginia)

	1 yr Term		3 yr Term	
	Upfront	Hourly	Upfront	Hourly
Standard Reserved Instances				
Small (Default)	$61	$0.034 per Hour	$96	$0.027 per Hour
Medium	$122	$0.068 per Hour	$192	$0.054 per Hour
Large	$243	$0.136 per Hour	$384	$0.108 per Hour
Extra Large	$486	$0.271 per Hour	$768	$0.215 per Hour
Second Generation Standard Reserved Instances				
Extra Large	$517	$0.299 per Hour	$807	$0.236 per Hour
Double Extra Large	$1034	$0.598 per Hour	$1614	$0.472 per Hour
Micro Reserved Instances				
Micro	$23	$0.012 per Hour	$35	$0.012 per Hour
High-Memory Reserved Instances				
Extra Large	$272	$0.169 per Hour	$398	$0.136 per Hour
Double Extra Large	$544	$0.338 per Hour	$796	$0.272 per Hour
Quadruple Extra Large	$1088	$0.676 per Hour	$1592	$0.544 per Hour
High-CPU Reserved Instances				
Medium	$161	$0.09 per Hour	$243	$0.079 per Hour
Extra Large	$644	$0.36 per Hour	$972	$0.316 per Hour

Dynamic Pricing

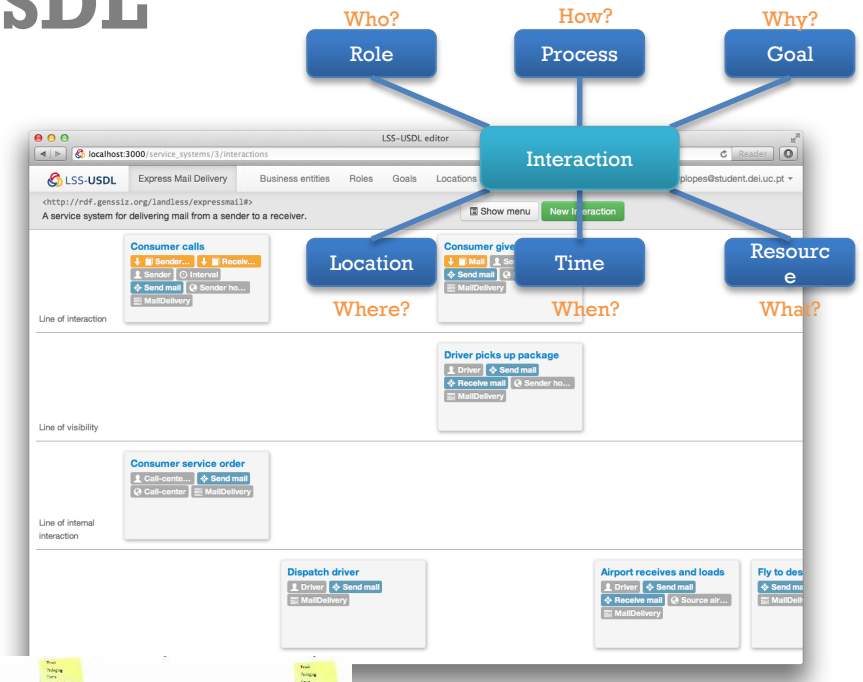


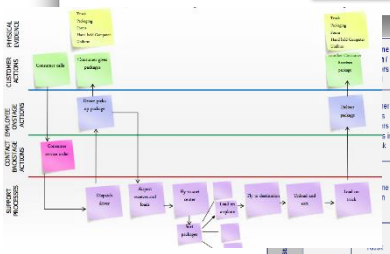
University of Coimbra, PT
The Open University, UK
SAP Research, DE

Service Systems

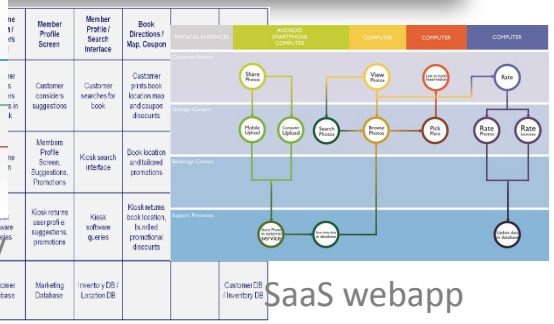
LSS USDL

- Service System model
  - Machine-understandable and processable
- Existing work
  - External perspective: WSDL, SAWSDL, USDL
  - Black-box
  - How can a service system be integrated with other services?
- Internal perspective
  - White-box approach and
  - Service management, optimization, and analytics.
  - How does the service works internally?





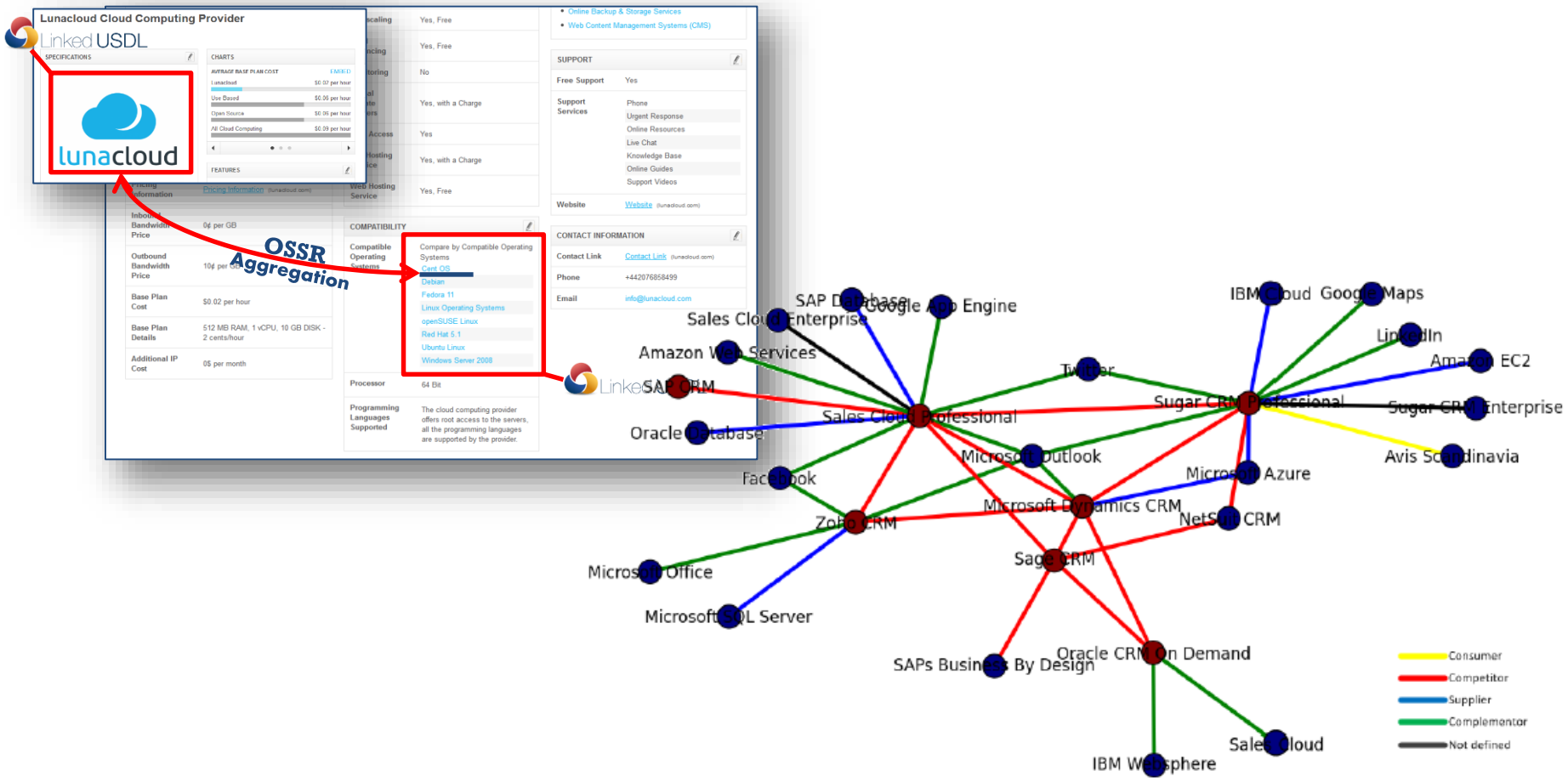
Express mail delivery (Gremler 2011)



SaaS webapp Bookstore kiosk (Lopes et al. 2012) (Glushko 2010)

Service Networks

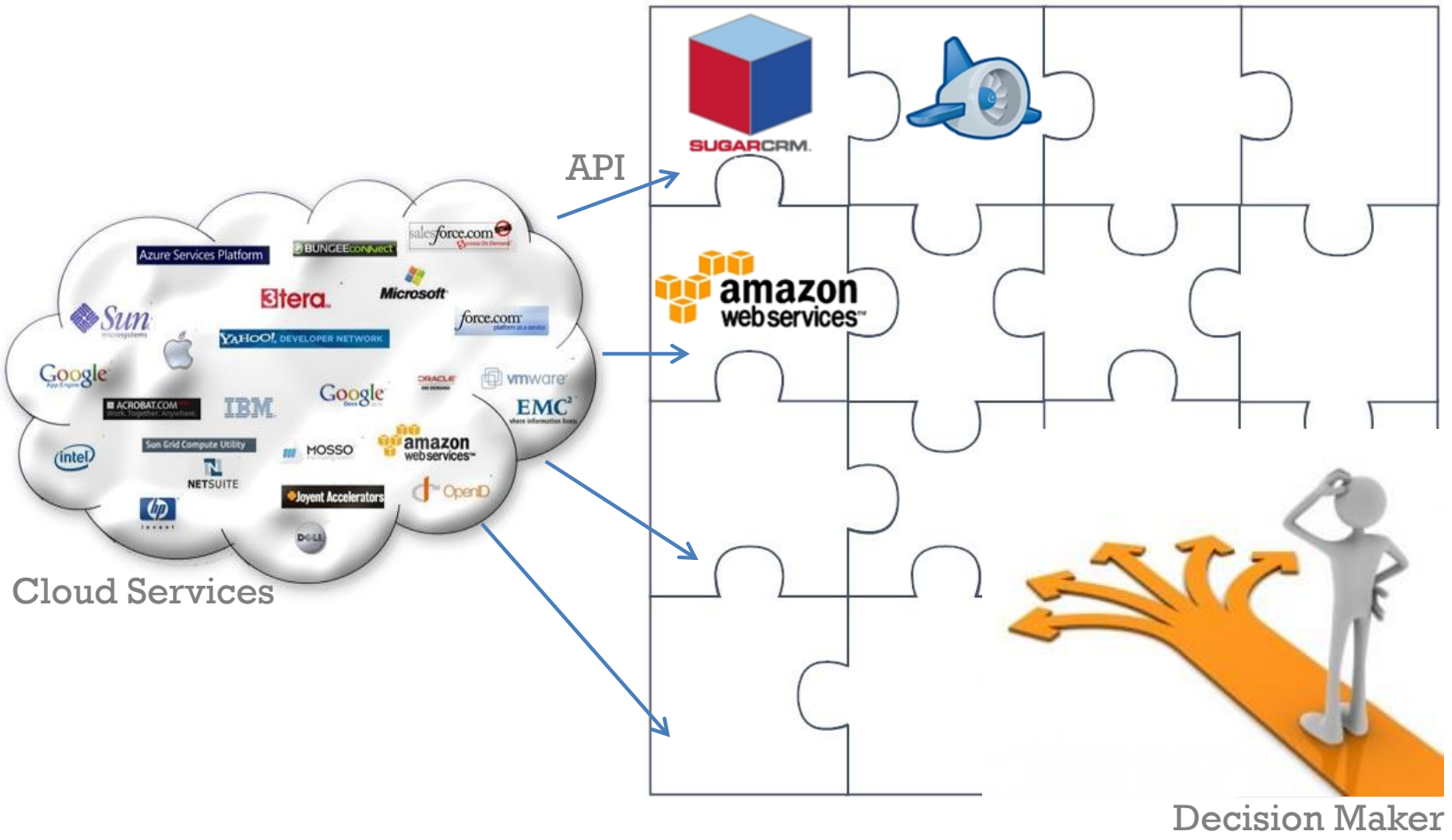
Linked USDL + OSSR = OSSN



Applications (2013)

Linked USDL and Cloud Services

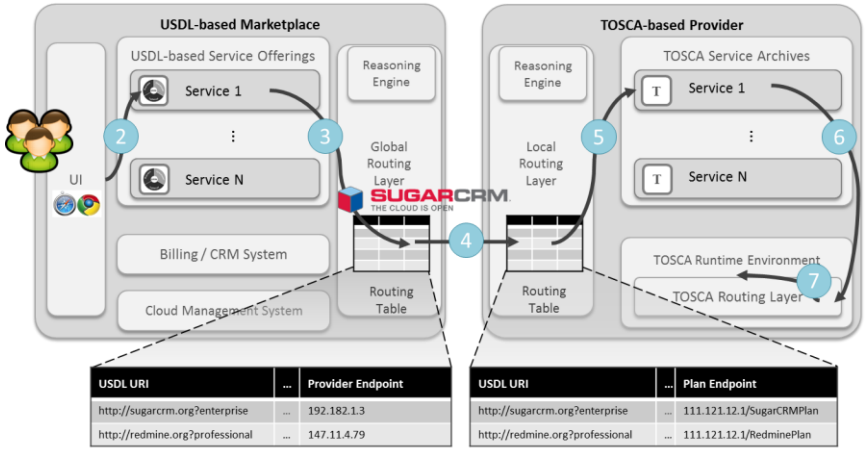
Consider cost, compatibility, space, speed, etc.



Applications (2013)

- Cloud Services (USDL & TOSCA)
  - University of Stuttgart, DE
- Could Service Aggregation
  - INESC, PT
- Service System Costing
  - Vienna Univ. of Technology, AT
  - Karlsruhe Inst. of Technology, DE
- ITIL Service Management
  - Portugal Telecom, PT
- Linked Open Data Integration
  - Portugal Telecom, PT
- Process Navigation
  - University of Bayreuth, DE

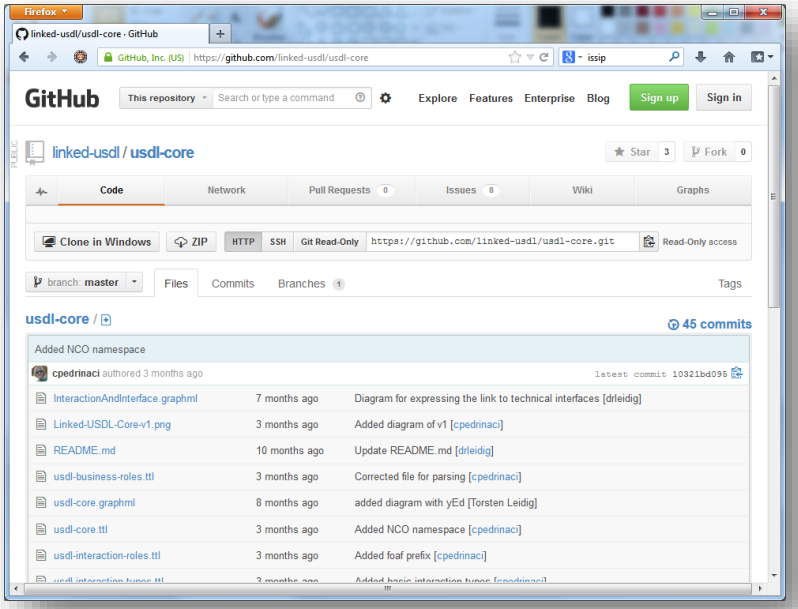
USDL & TOSCA Integration



Linked Open Data Integration

Resources

http://www.linked-usdl.org/

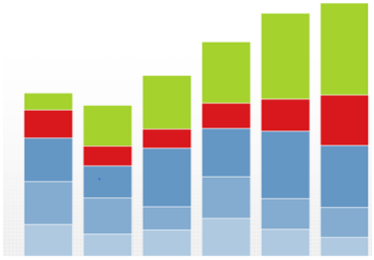


https://github.com/linked-usdl/
https://github.com/Genssiz

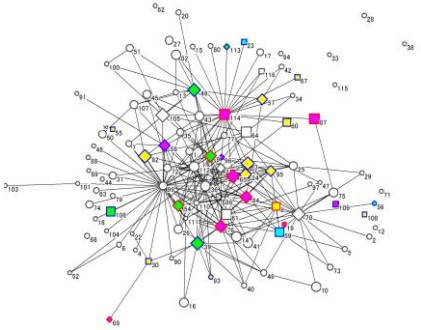
Linked USDL

Next Steps (2014)

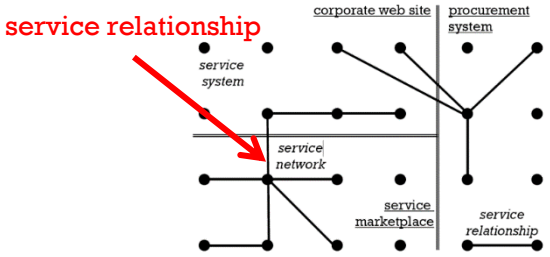
- Service Analytics
  - Service system mining
  - Process mining
  - Data mining



- Service Network Analysis
  - Automated reconstruction
  - Domain-specific metrics



- Service Relationships
  - Evidence from Social Networks
  - Text mining techniques
  - Co-occurance analysis



Karlsruhe Service Research Institute (KSRI)

Karlsruhe Institute of Technology (KIT)

Employees

9.261

Students

23.836

364

Professors

789

Millionen Annual Budget

- Research, teaching, and innovation
- Merger of former University of Karlsruhe and Forschungszentrum Karlsruhe (Oct '09)

KSRI Setup

Energy Economics

Prof. Dr. Wolf Fichtner

Service Innovation & Managen

Prof. Dr. Hansjörg Fromm

IBM

Discrete Optimization & Logi

Prof. Dr. Stefan Nickel

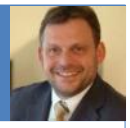
Software Design & Quality

Prof. Dr. Ralf Reussner

Knowledge Management

Prof. Dr. Rudi Studer

Information & Market Engineering

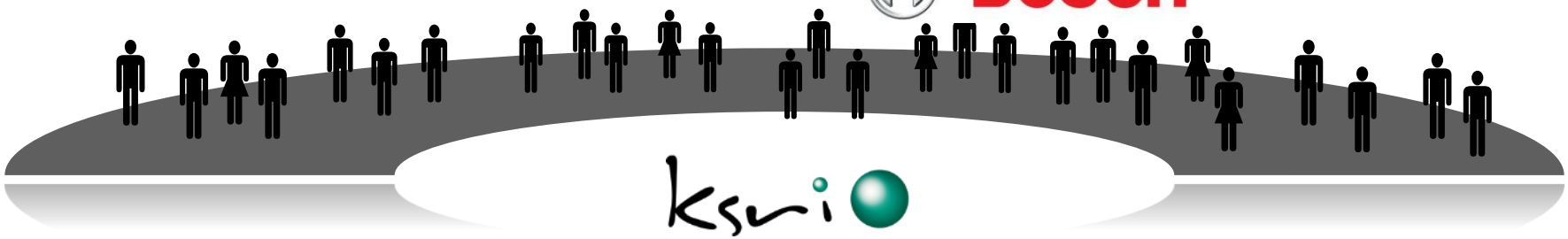


Prof. Dr. Christof Weinhardt

Value Stream Services

Dr. Helmut Wlcek,
Prof. Dr. Kai Furmans

BOSCH

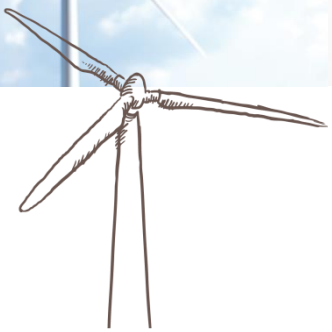


ksri

Joint Management ▪ Joint Infrastructure
Joint Interdisciplinary Research Projects ▪ Joint Graduate Program

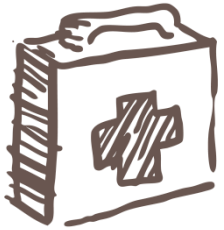
Industry domains

Energy



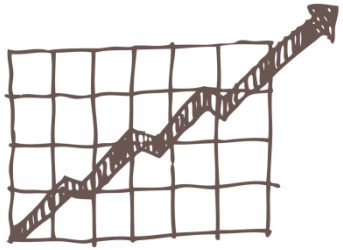
ICT

Healthcare



Mobility and Supply Chain

Finance



Facilities and Production

… and new service-based business models gain economic value fast.

Gartner estimates 35% of all CRM implementations today use SaaS, growing to over 50% by 2020 according to their projections

(Gartner, 5/2012).

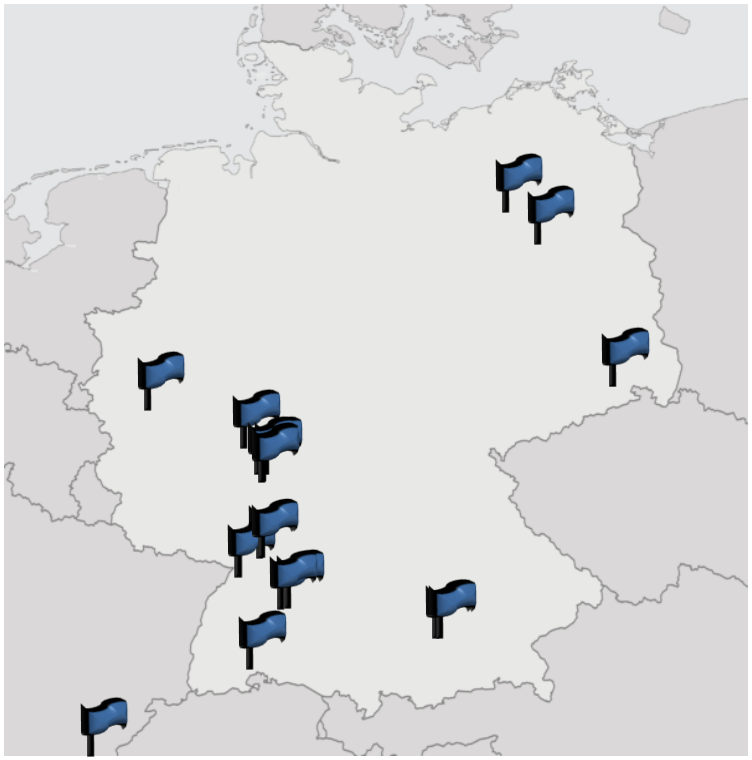
salesforce.com

	1 month returns	YTD returns	1 year returns*	3 year returns
salesforce.com	2.52%	2.52%	47.55%	171.2%
S&P 500 Total Return	7.23%	5.44%	17.02%	49.08%
Oracle Corporation	6.21%	6.21%	26.92%	57.66%
Microsoft Corporation	3.05%	3.05%	-4.15%	5.25%

CRM Vendors	2010	2011	Share (%) 2010	Share (%) 2011	Growth (%) 2011
SAP	2,006.5	2,324.8	18.9	19.3	16.3
Salesforce.com	1,749.4	2,006.5	16.5	16.7	35.9
Oracle	1,476.3	1,918.2	16.0	26.6	9.7
Microsoft	793.3	901.0	7.5	7.5	13.6

Source: Gartner 05/2012 & http://ycharts.com/companies/CRM/performance

Company partner network (selection)



Deutsche Telekom Laboratories

CAS SOFTWARE

IBM

SAP

BMW

EnBW

ABB

Microsoft

EADS

HYVE

traffic mobility logistics.

OPEL

Wir leben Autos.

STADTWERKE KARLSRUHE
VERSORGUNG MIT VERANTWORTUNG

BOSCH

DAIMLER

DB Mobility Networks Logistics

Service Research Events at KSRI

1st Karlsruhe Service Summit
December 2008

1st Karlsruhe Summer School on Service Research
July 2010

2nd Karlsruhe Summer School on Service Research
September 2013

2nd Karlsruhe Service Summit
July 2010

3rd Karlsruhe Service Summit
January 2012

4rd Karlsruhe Service Summit
September 2013

KSRI speaker series from
2008 - 2013



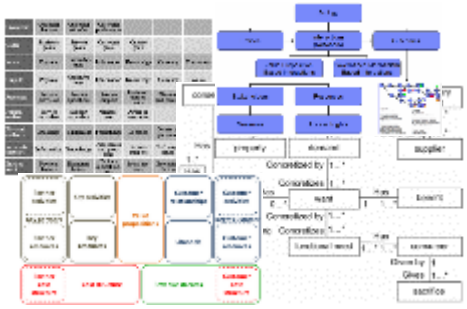




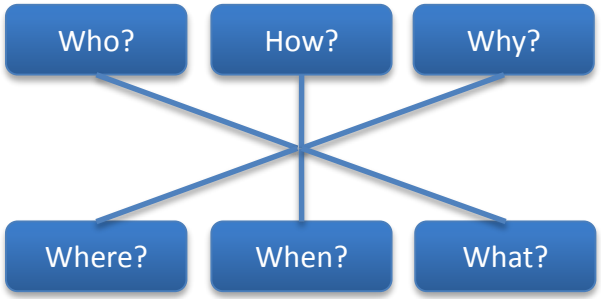


Thank You *for* Listening

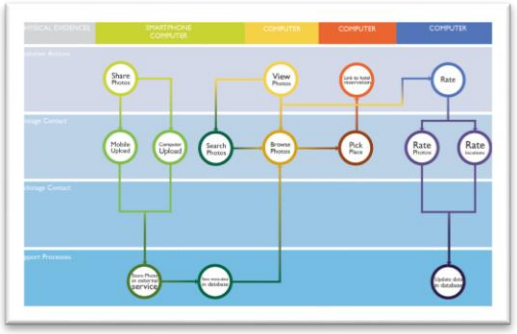
LSS-USDL building blocks



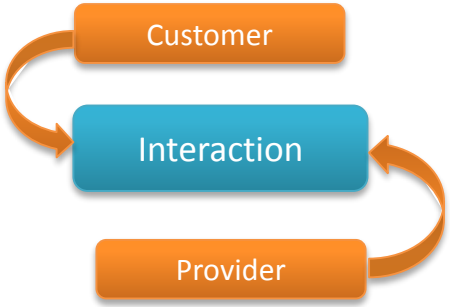
Literature review



Star model (5W+H)



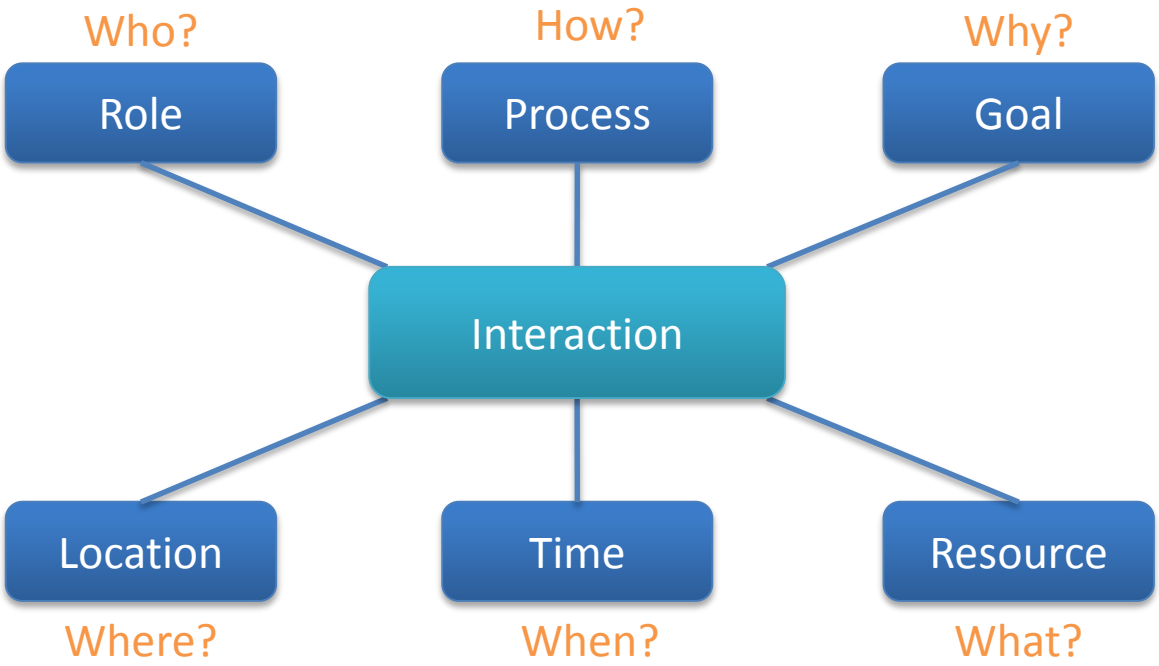
Service blueprint



Co-creation

LSS-USDL

6-Point interaction star model



LaNDLESS

Integrating Linked Data with Linked Services

Ricardo Lopes

Dept. Engenharia Informática - University of Coimbra

LaNDLESS

Introduction

The Service Model

Tool Support

Evaluation

Conclusions

LaNDLESS

Introduction

The Service Model

Tool Support

Evaluation

Conclusions

Services

70% of Western Europe's GDP Luczak et al. (2007)

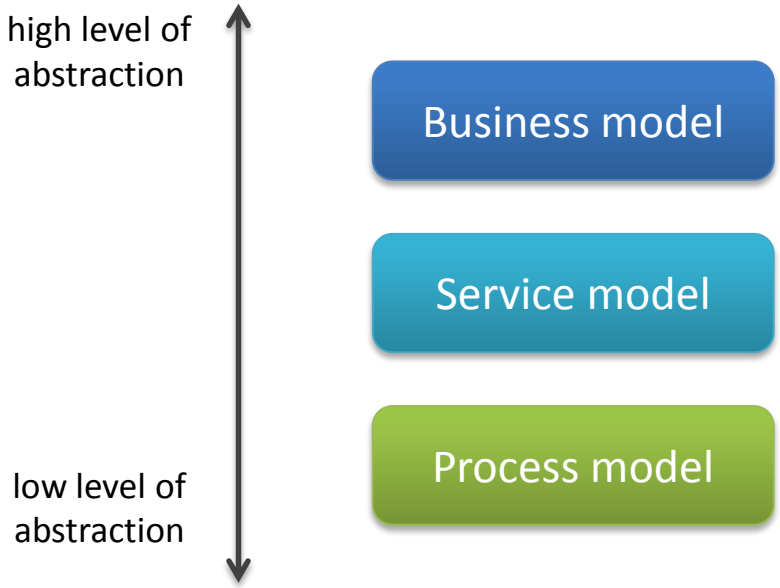
Growth in the last 25 years: Maglio et al. (2006)

- Germany: +44%
- Japan: +40%
- China: +191%
- …

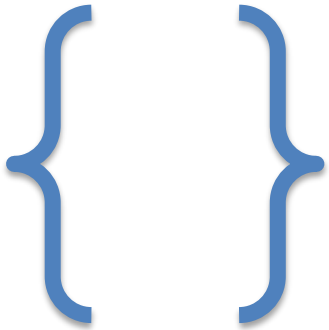
Services

Chesbrough et al. (2006)

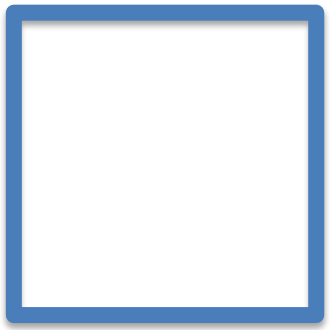
Still hardly studied



Motivation



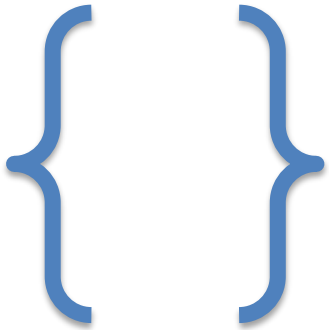
Machine-readable



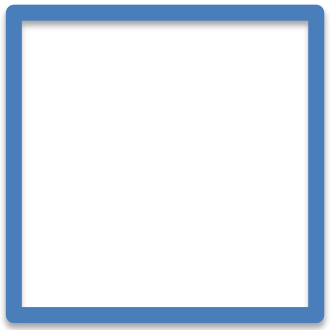
Whitebox

Better Service Systems Documentation

Motivation



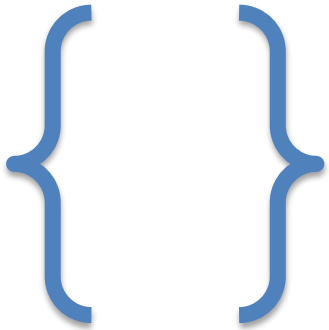
Machine-readable



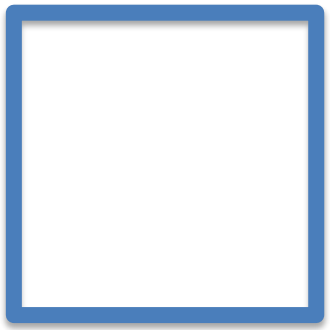
Whitebox

Better Service Systems Transparency

Motivation



Machine-readable

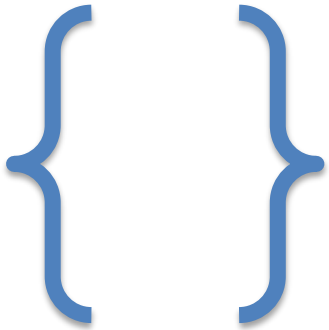


Whitebox

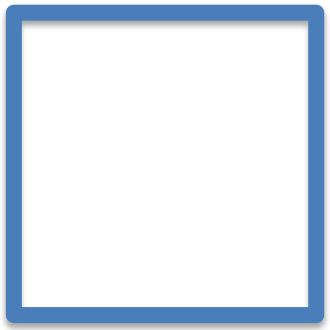
Better Service Systems

Bottlenecks and fail points identification

Motivation



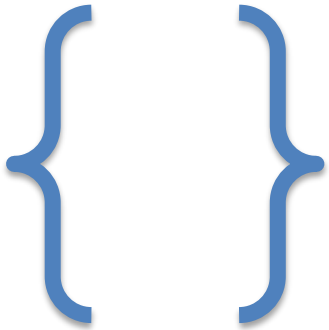
Machine-readable



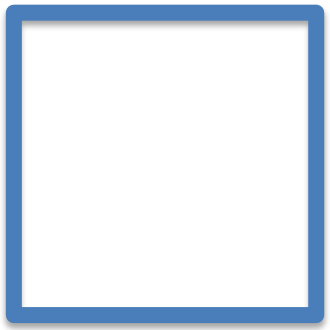
Whitebox

Better Service Systems Automation

Motivation



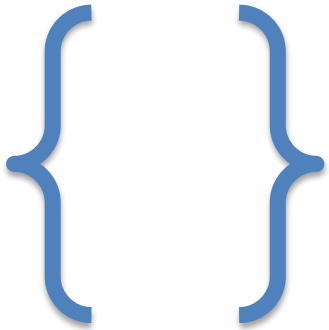
Machine-readable



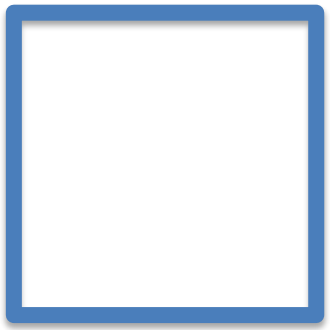
Whitebox

Better Service Systems Simulation

Motivation



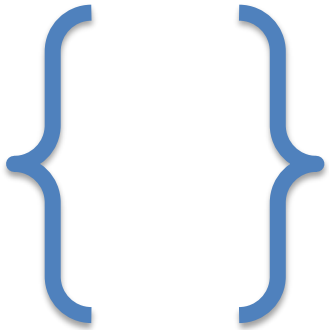
Machine-readable



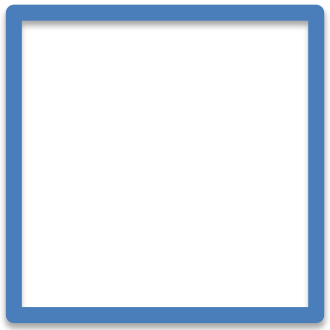
Whitebox

Better Service Systems Integration

Motivation



Machine-readable



Whitebox

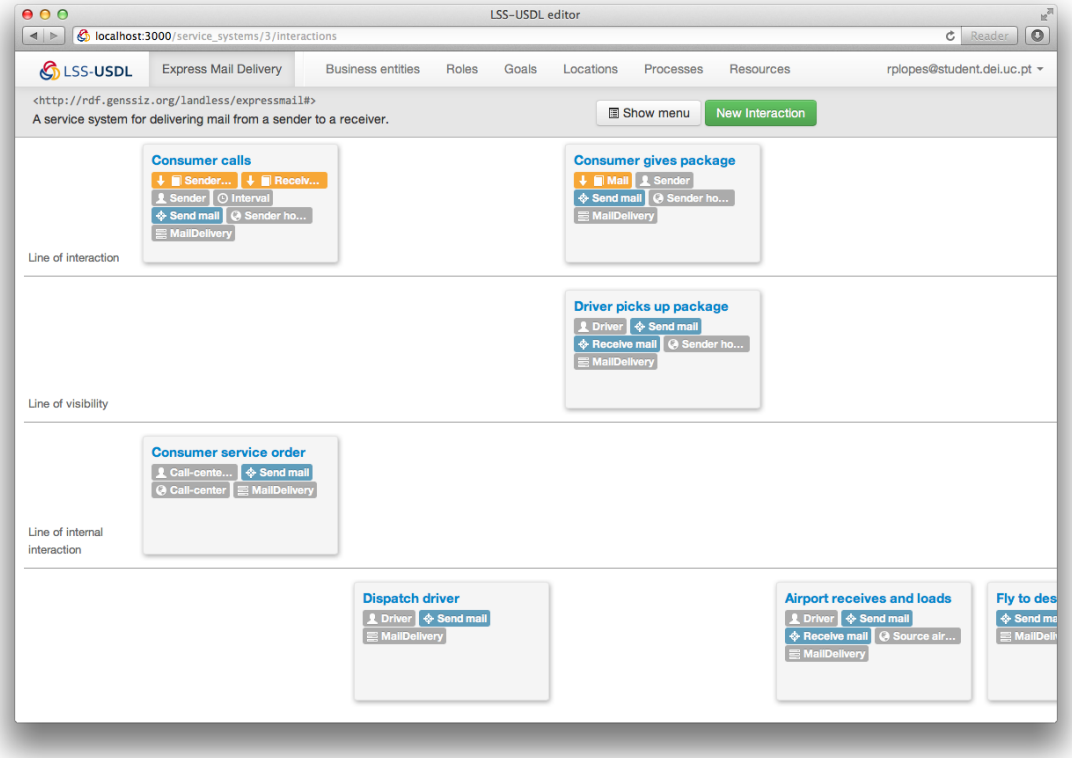
Better Service Systems Discovery

Objectives and Challenges

1. Define a service system model

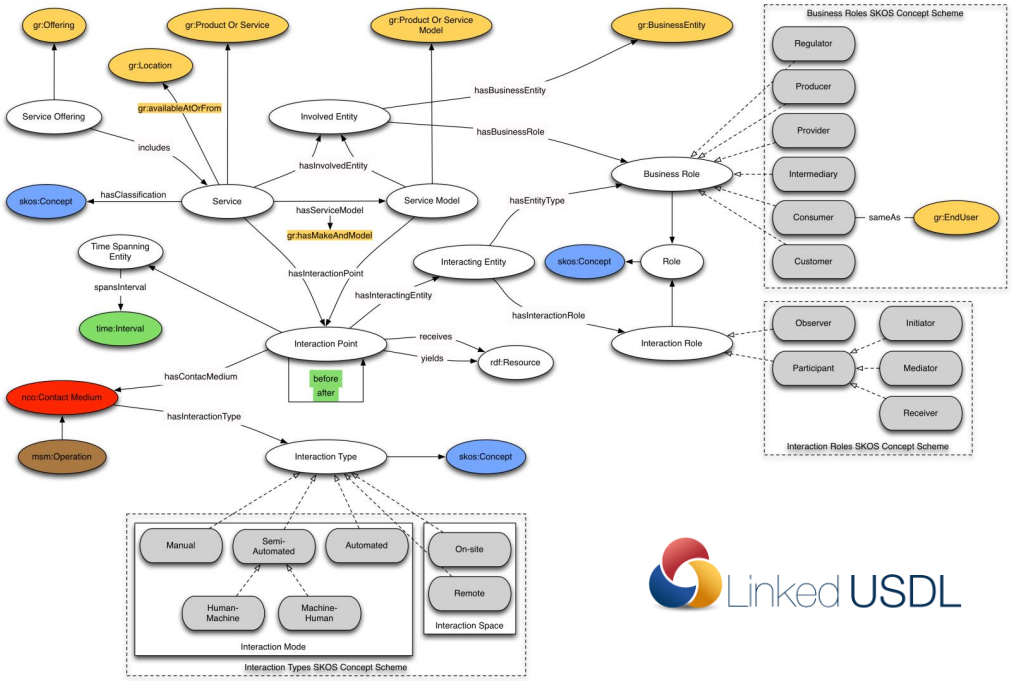
Objectives and Challenges

2. Develop a graphical modeling tool



Objectives and Challenges

3. Align the model with Linked USDL



LaNDLESS

Introduction

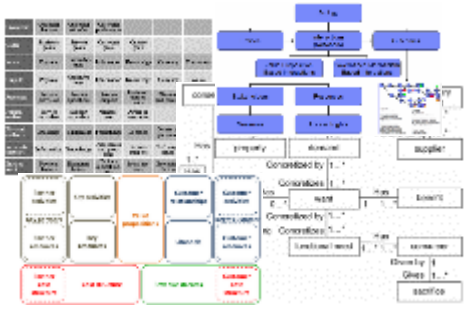
The Service Model

Tool Support

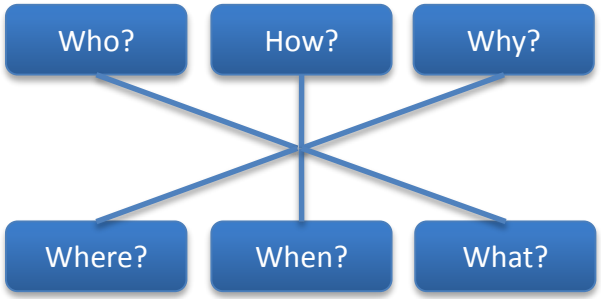
Evaluation

Conclusions

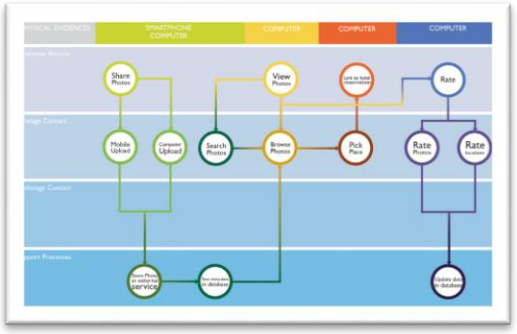
LSS-USDL building blocks



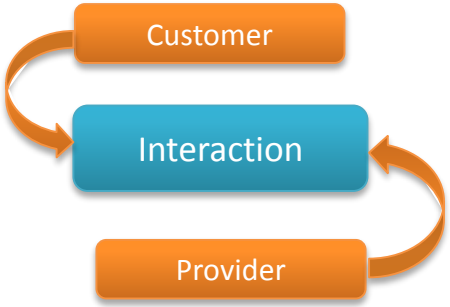
Literature review



Star model (5W+H)



Service blueprint



Value co-creation

LSS-USDL building blocks

Literature review

Alt and Zimmermann (2001)

Petrovic et al. (2001)

Kanner and Karni (2007)

Kinderen and Gordijn (2008)

Spohrer and Maglio (2009)

Osterwalder and Pigneur (2010)

Fielt (2010)

Zolnowski et al. (2011)

Goals

Stakeholders

Processes

Inputs

Outputs

Resources

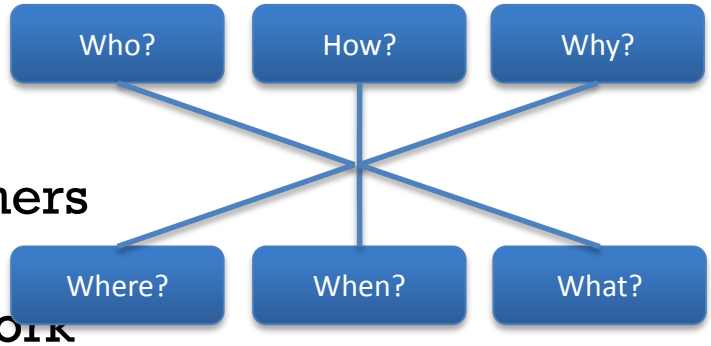
Measures

Legal

Financial

LSS-USDL building blocks

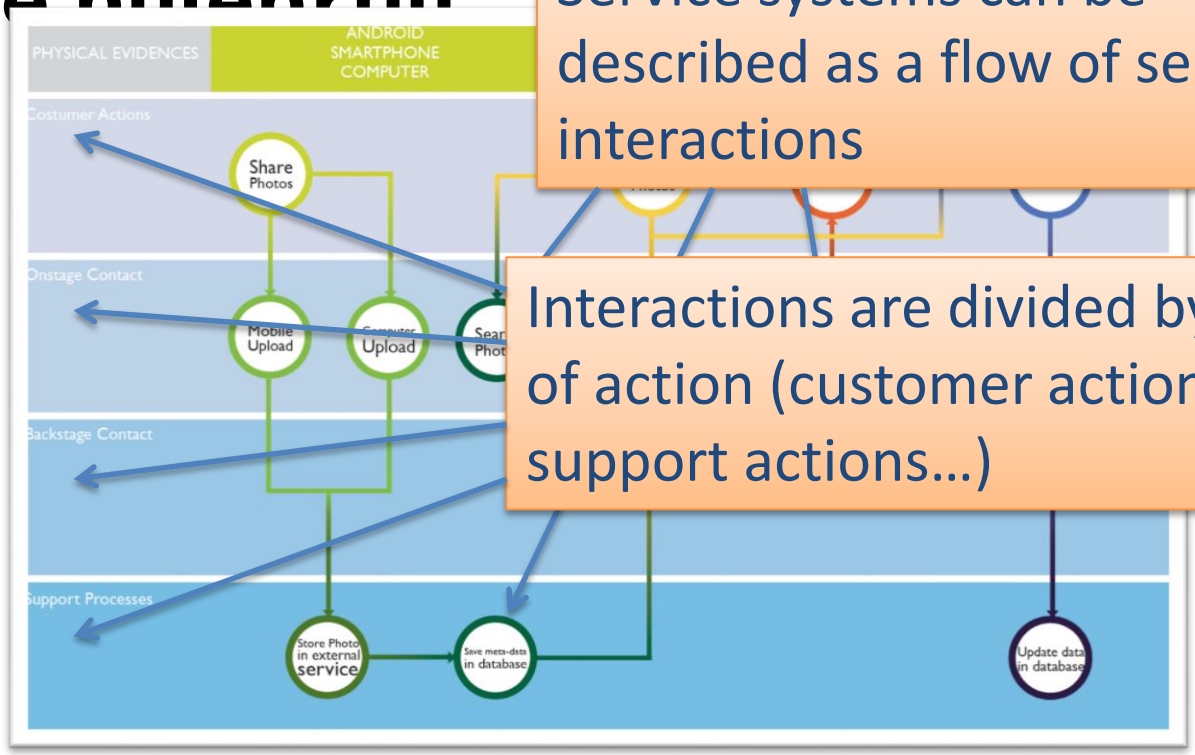
Star model (5W+H)



- Very popular in journalism and others
- Core concept in Zachman Framework
- Other uses found in the literature
  - Blair et al. (1994)
  - Dumas et al. (2003)
  - Söderström et al. (2006)

LSS-USDL building blocks

Service blueprint



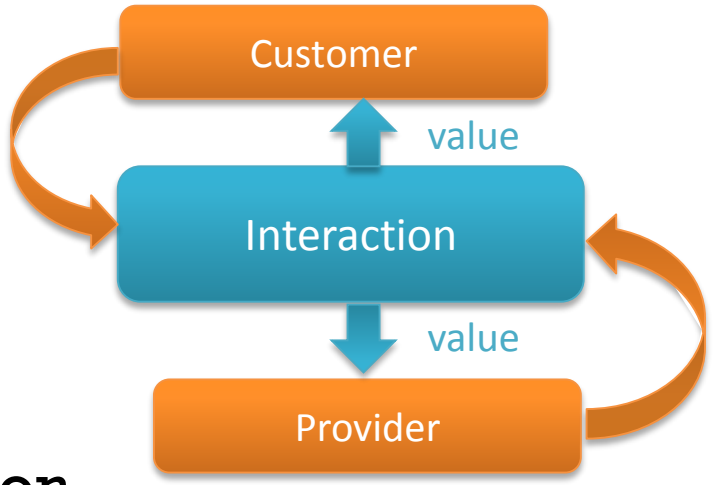
Service systems can be described as a flow of service interactions

Interactions are divided by areas of action (customer actions, support actions…)

Shostack (1984)

LSS-USDL building blocks

Value co-creation



– Goods Dominant Logic:

- Value is in goods transaction

– Service Dominant Logic:

- Value is co-created in service interactions

Maglio et al.(2009)

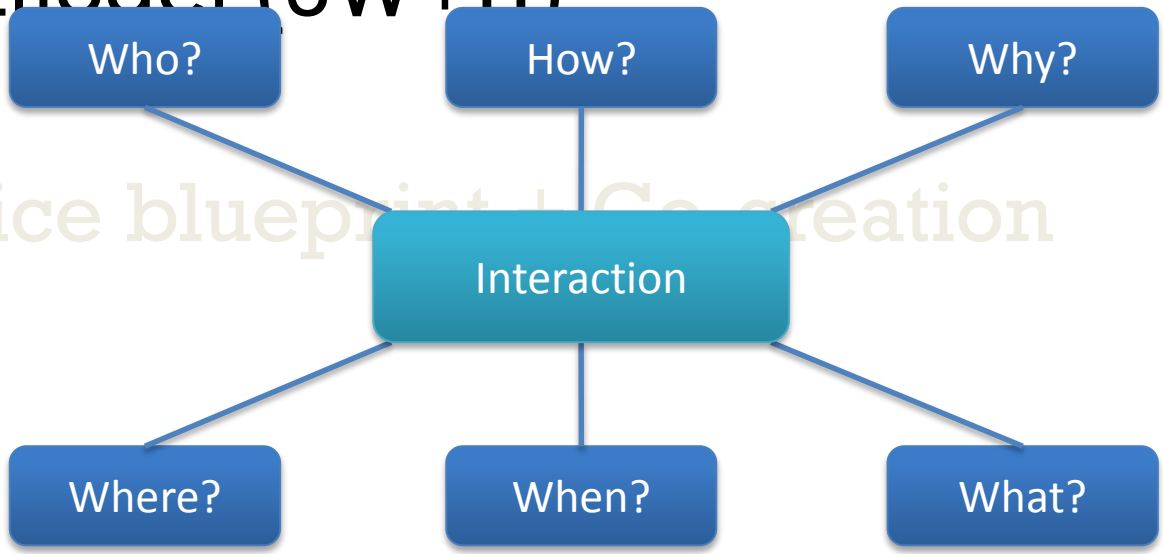
LSS-USDL building blocks

- Literature review
- Star model (5W+H)
- Service blueprint + Co-creation

Interaction

LSS-USDL building blocks

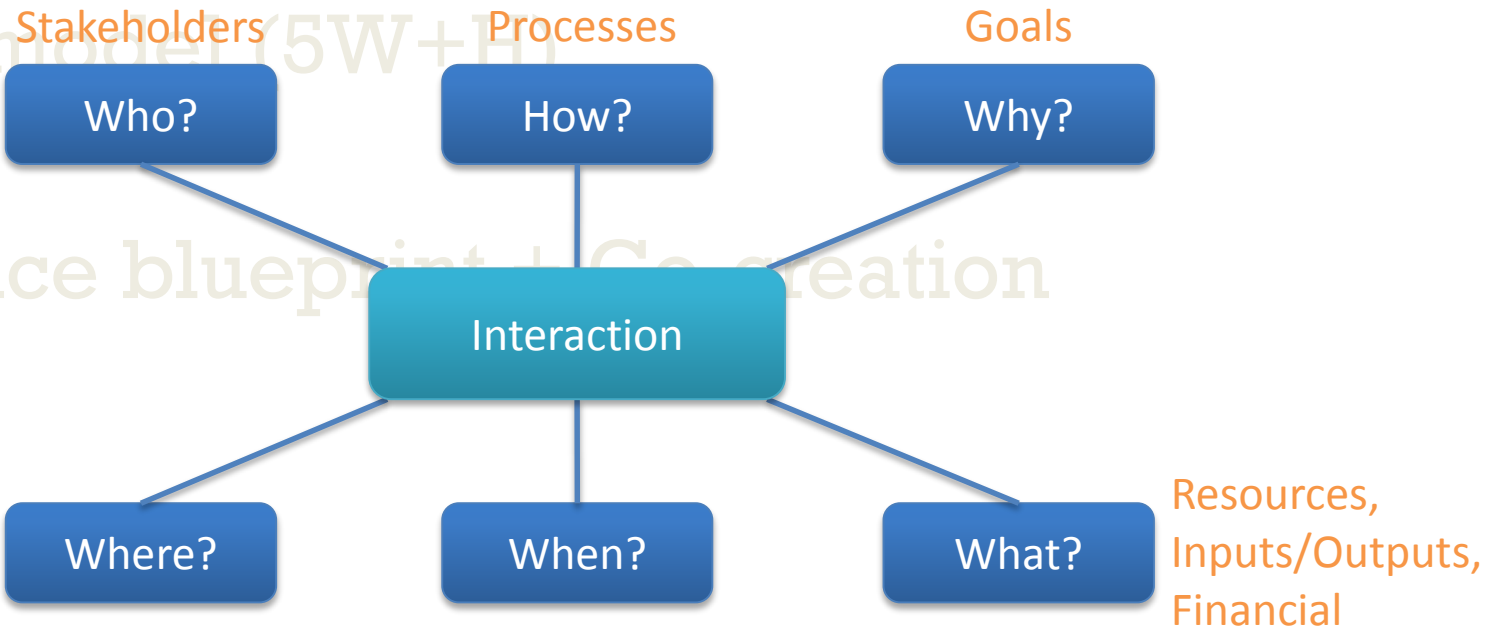
- Literature review
- Star model (5W+H)



- Service blueprint + Co-creation

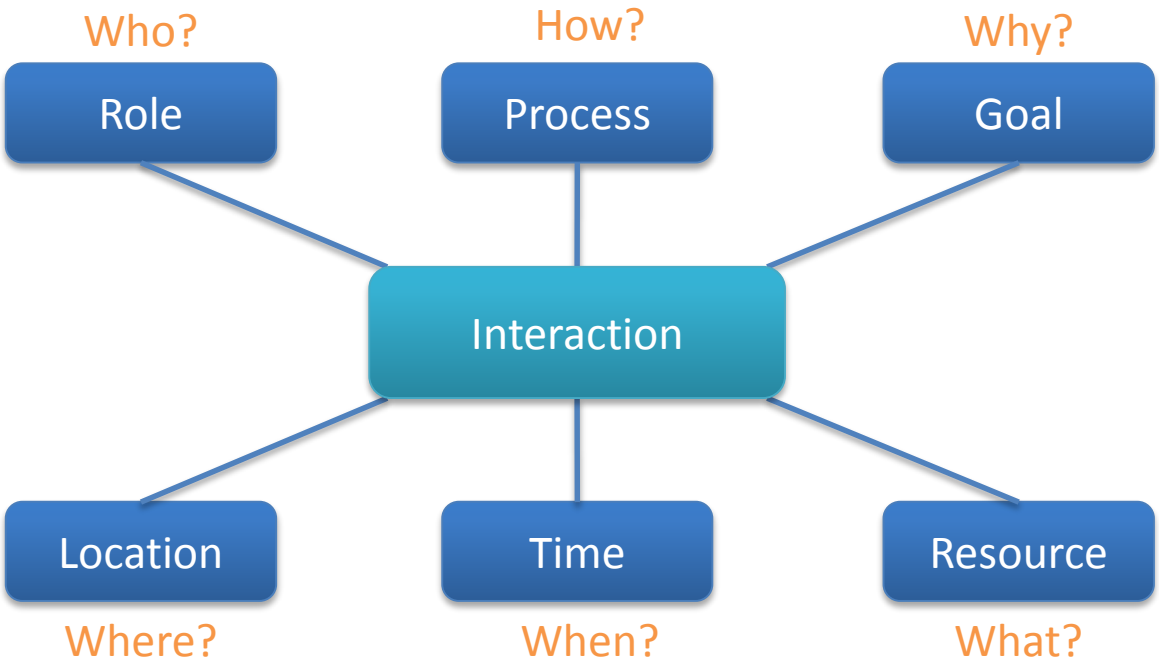
LSS-USDL building blocks

- Literature review



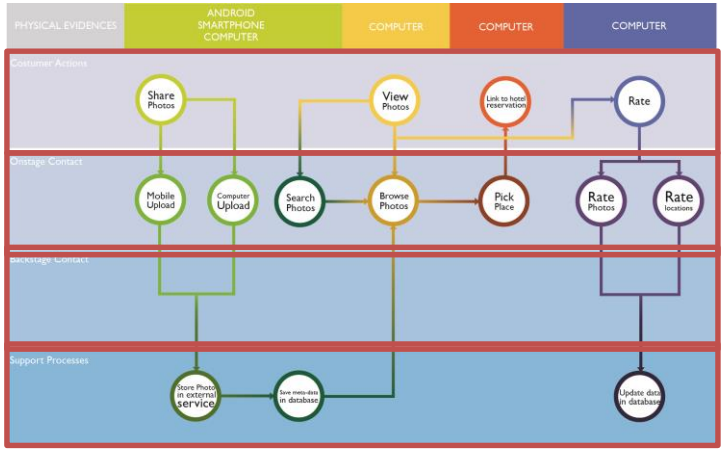
LSS-USDL

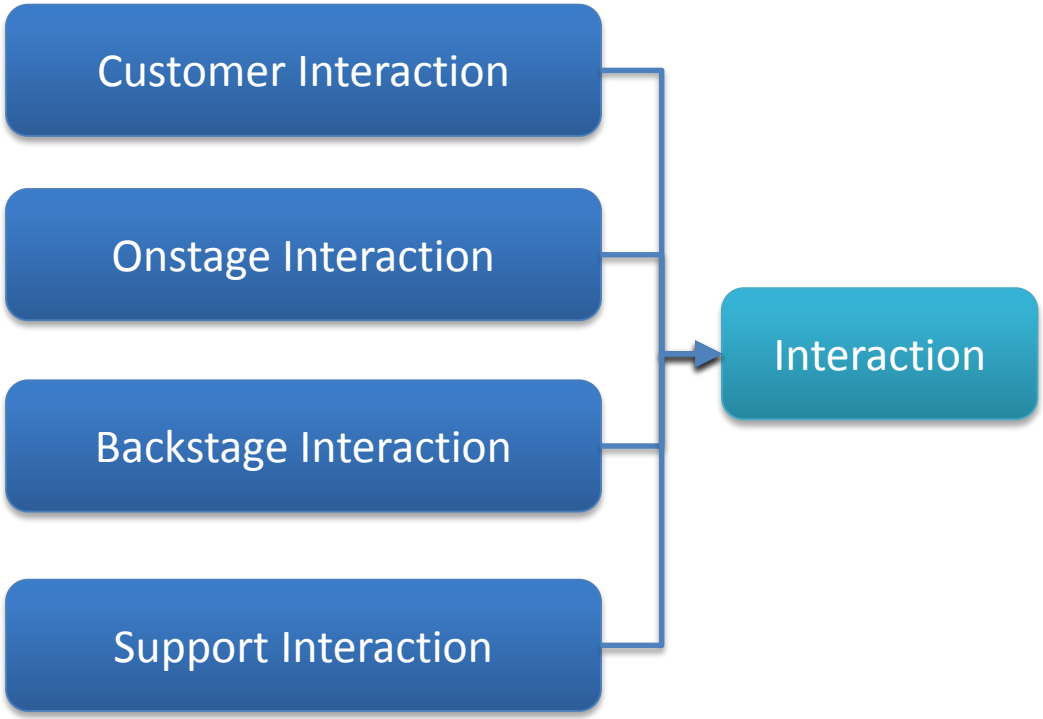
6-Point interaction star model



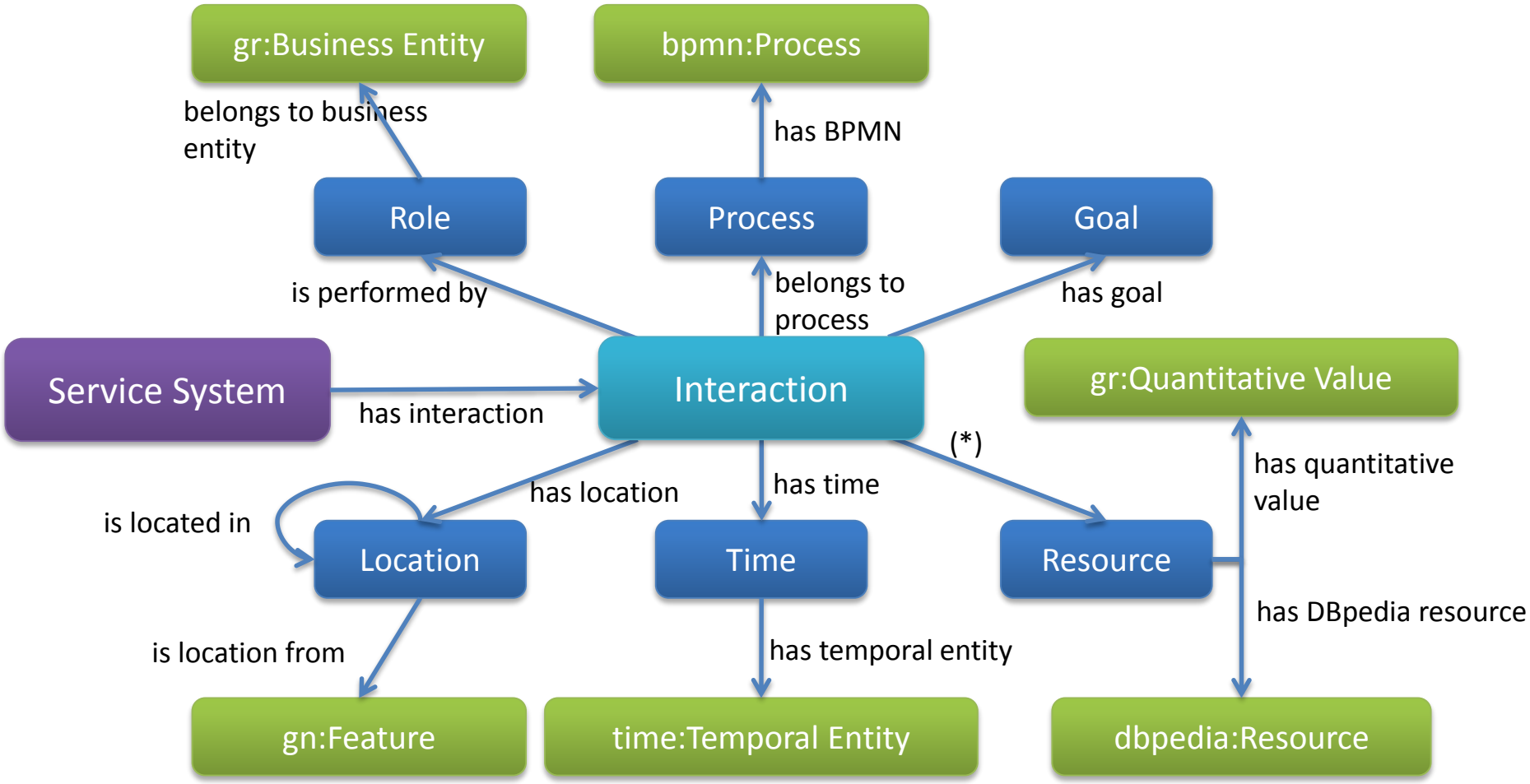
LSS-USDL

Interaction types (from service





LSS-USDL



(*) – receives resource, creates resource, consumes resource, returns resource

LSS-USDL instances

E.g.: Express Mail Delivery

– Consider the interaction "Customer delivers packages"


```
:CustomerDeliversPackages a lss-usdl:CustomerInteraction;
  rdfs:label "Customer delivers packages";
  lss-usdl:isPerformedBy :Sender;
  lss-usdl:hasGoal :SendMail;
  lss-usdl:hasTime [
    a lss-usdl:Time;
    lss-usdl:hasTemporalEntity :ConsumerGivesPackagesTime
  ];
  lss-usdl:hasLocation :SenderHome;
  lss-usdl:belongsToProcess :MailDelivery;
  lss-usdl:receivesResource :Mail.
:ConsumerGivesPackagesTime a time:ProperInterval;
  time:hasDateTimeDescription [
    a time:DateTimeDescription;
    time:hour 14
  ].
```

LaNDLESS

Introduction

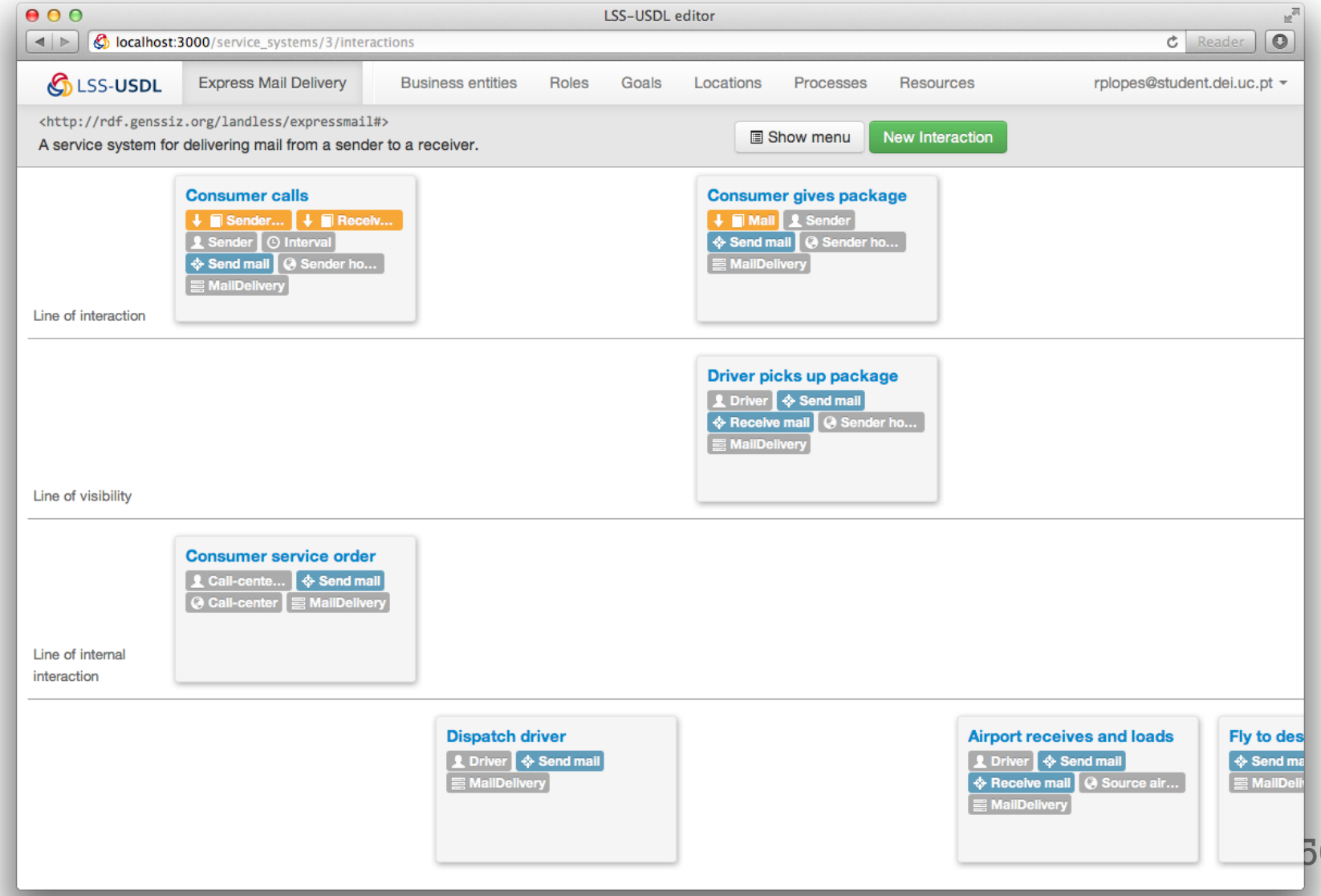
The Service Model

Tool Support

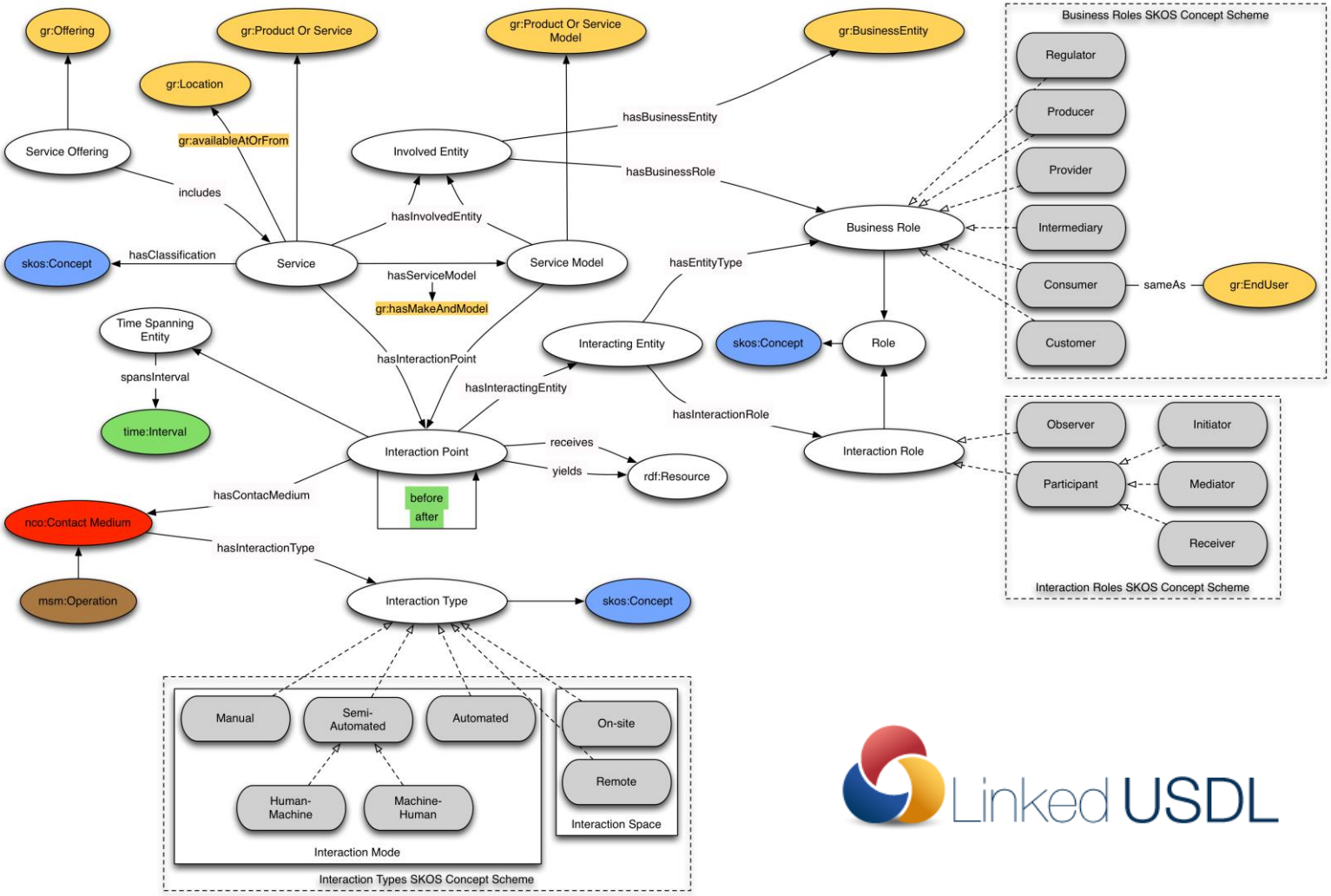
Evaluation

Conclusions

LSS-USDL editor



Linked USDL mapping

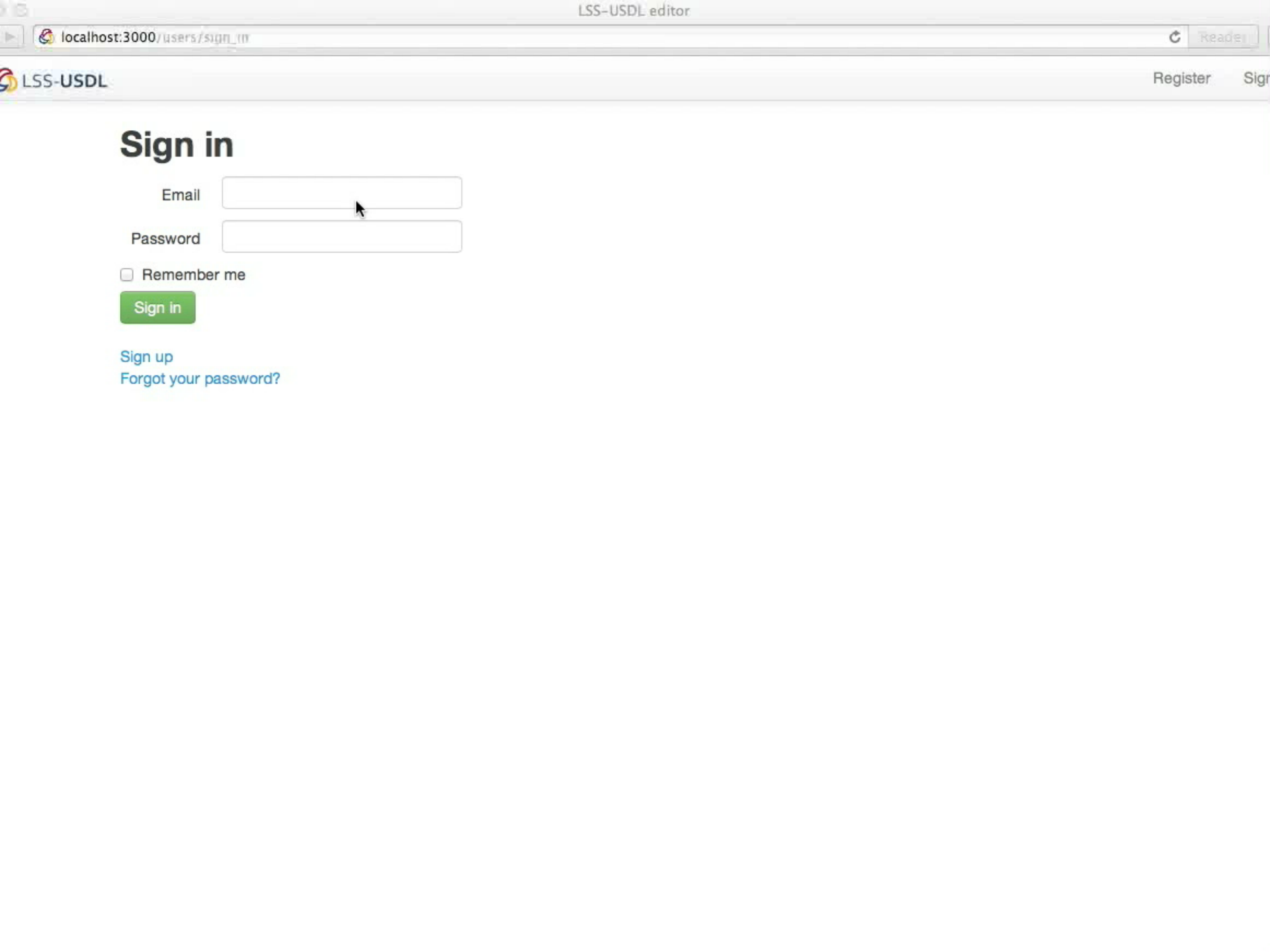


Linked USDL

Linked USDL mapping

LSS-USDL	Linked USDL
ServiceSystem	Service
CustomerInteraction	InteractionPoint
Role	InteractingEntity
Time	TimeSpanningEntity
Resource	rdf:Resource
hasInteraction	hasInteractionPoint
isPerformedBy	hasInteractingEntity
hasTemporalEntity	spansInterval
receivesResource	receives
returnsResource	yields

Demo


LSS-USDL editor
localhost:3000/users/sign_in
LSS-USDL
Register
Sign
Sign in
Email
Password
Remember me
Sign in
Sign up
Forgot your password?

LaNDLESS

Introduction

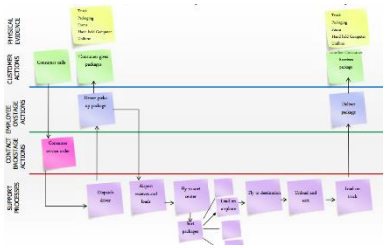
The Service Model

Tool Support

Evaluation

Conclusions

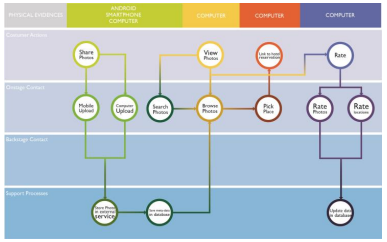
Evaluation



Express mail delivery
(Gremler 2011)

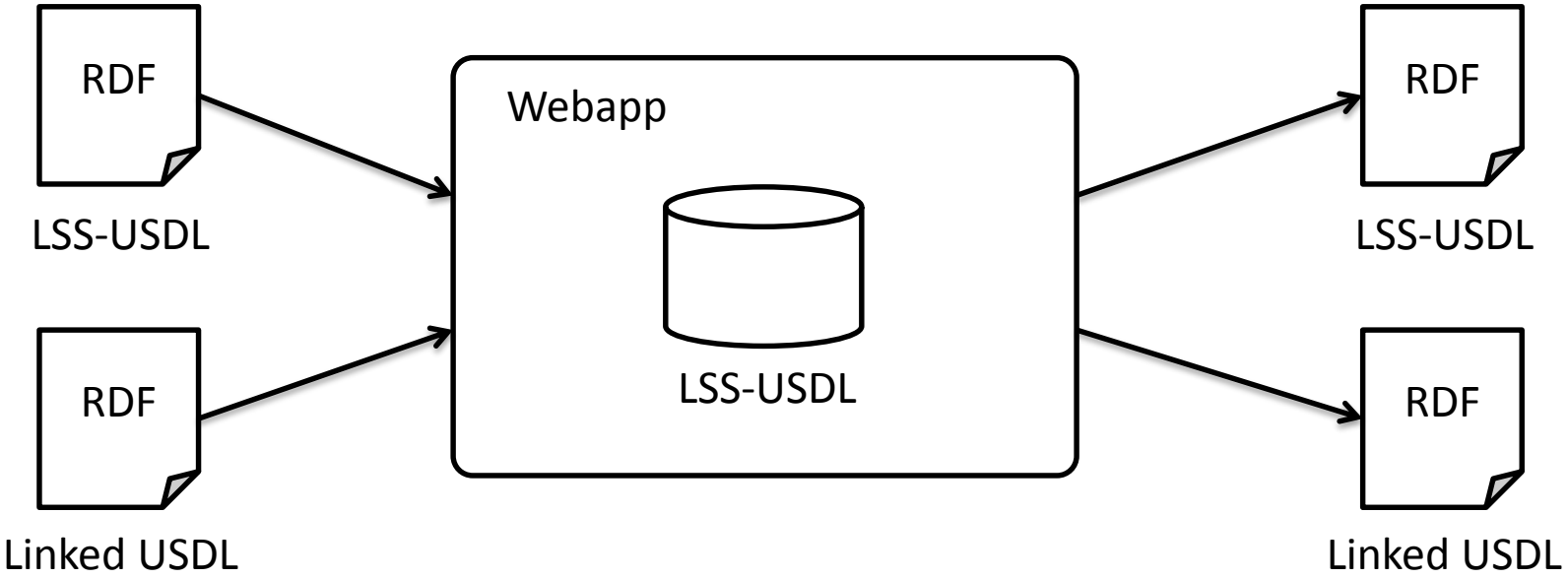
Physical Evidence	Kiosk	Welcome Screen / Members Card	Member Profile Screen	Member Profile / Search Interface	Book Directions / Map, Coupon	Books	Books / Receipt
User Actions	Customer approaches bookstore kiosk	Customer swipes members card, logs in to kiosk	Customer considers suggestions	Customer searches for book	Customer prints book location map and coupon discounts	Customer walks to book locations and retrieves books	Customer discards one book and purchases the rest
Front Stage		Welcome Screen	Members Profile Screen, Suggestions, Promotions	Kiosk search interface	Book location and utilized promotions		Checkout and registers
Back Stage		Kiosk software queries	Kiosk returns user profile suggestions, promotions	Kiosk software queries	Kiosk returns book location, bundled promotional discounts		Systems logs customer purchases
Support		Customer Database	Marketing Database	Inventory DB / Location DB			Customer DB / Inventory DB

Bookstore kiosk
(Glushko 2010)



SaaS webapp
(Lopes et al. 2012)

Evaluation


RDF
LSS-USDL
RDF
Linked USDL
Webapp
LSS-USDL
RDF
LSS-USDL
RDF
Linked USDL

LaNDLESS

Introduction

The Service Model

Tool Support

Evaluation

Conclusions

Findings

Service system model

Extensibility through software tools

Building block for data analysis

Future Work

Further improvements and validations

Better tool support

Business Intelligence

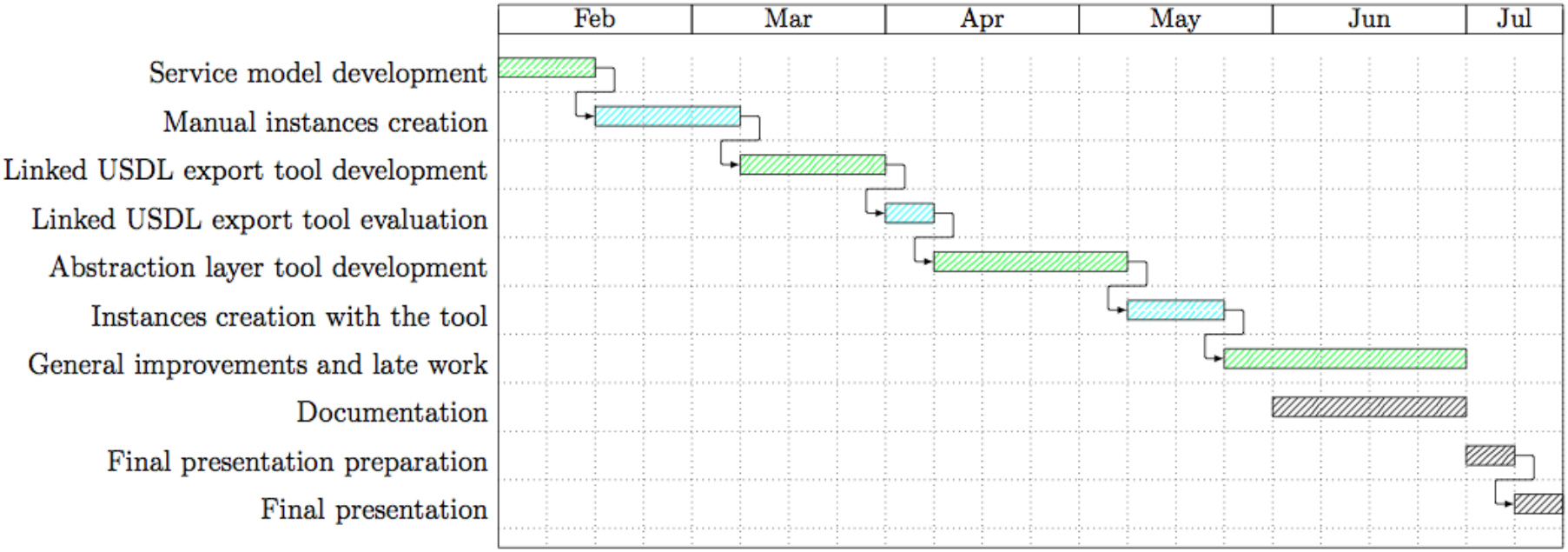
Integration with the *-USDL family

Ricardo Lopes

Dept. Engenharia Informática - University of Coimbra

Scheduling

Expected for the second semester



Scheduling

Actual execution of tasks