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Services
and
Business Process Outsourcing

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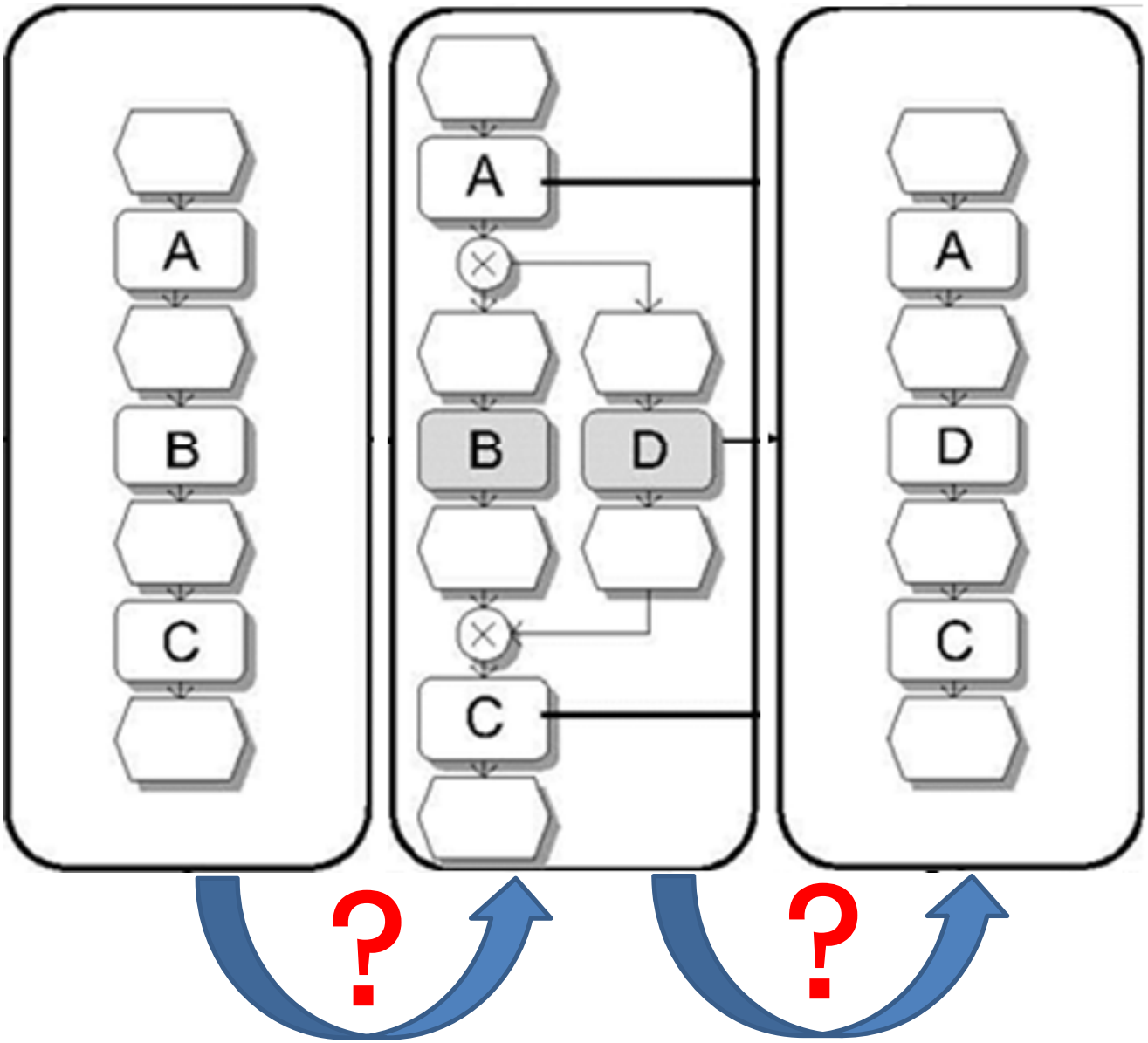
Topics

- Business Process Outsourcing
- Reference Models
- Compliance

- Services
- The Open Paradigm
- Open Services
- Open Service Querying

- Conclusions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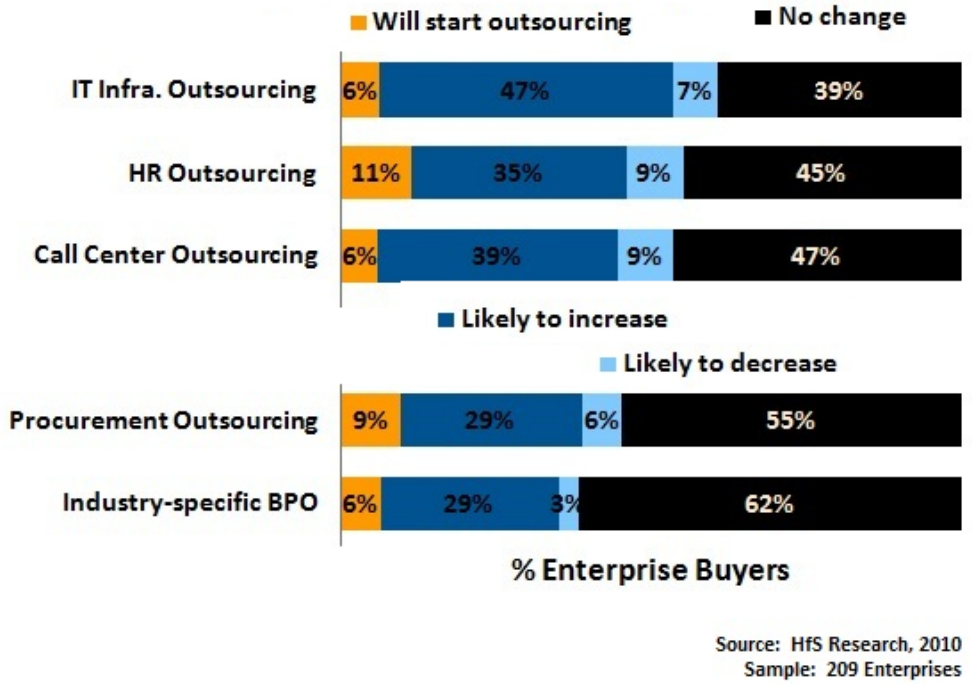
Business Process Outsourcing

Definition

The transfer of an organization's entire non-core but critical business process to an external vendor who uses an IT-based service delivery.



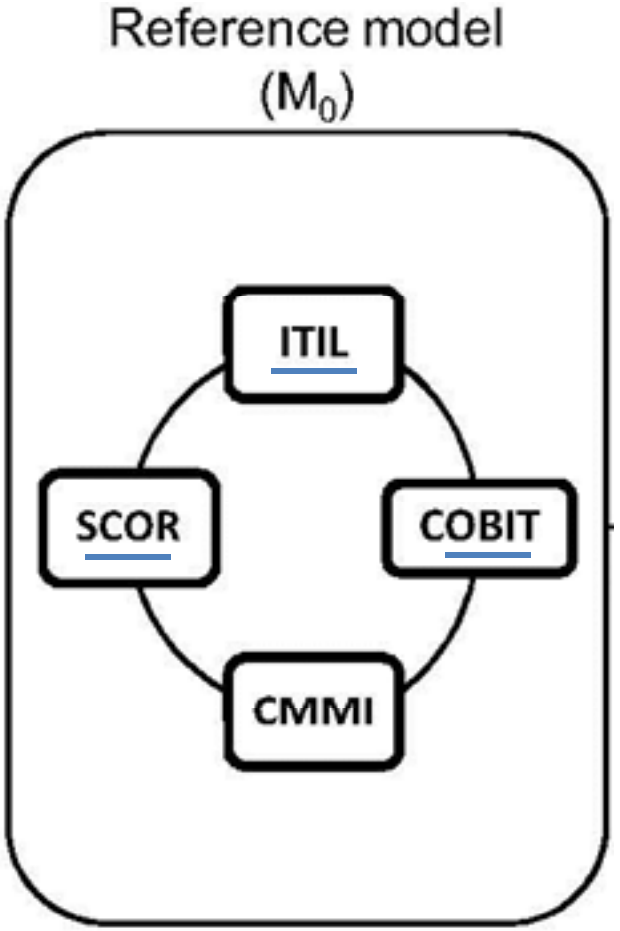
Source: HfS Research, 2010
Sample: 209 Enterprises

Reference Models

Information Technology Infrastructure Library (ITIL) describes an integrated best practice approach to managing and controlling IT service sevel.

The Control Objectives for Information and related Technology (COBIT) describe good practices, to provide information system auditing.

The Supply Chain Operations Reference Model (SCOR) links business processes to support communication and effectiveness among supply chain partners.

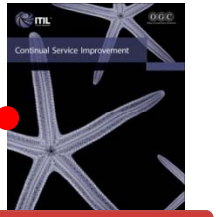


Reference Models

- Offer a set of generally accepted processes which are sound and efficient.
- Speed up the design of process models by providing reusable and high quality content.
- Optimize the design as they have been developed over a long period and usually capture the business insight of experts
- Ease the compliance with industry regulations and requirements and, thus, mitigate risk.

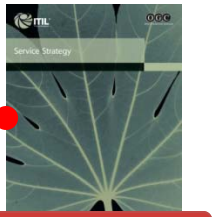
e.g. ITIL

Information Technology Infrastructure Library



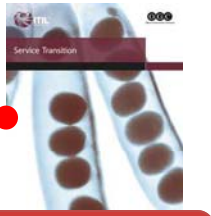
- 7 Step Improvement Process
- Service Reporting
- Service Measurement

- Service Catalogue Management
- Service Level Management
- Capacity Management
- Availability Management
- IT Service Continuity Management
- Information Security Management
- Supplier Management

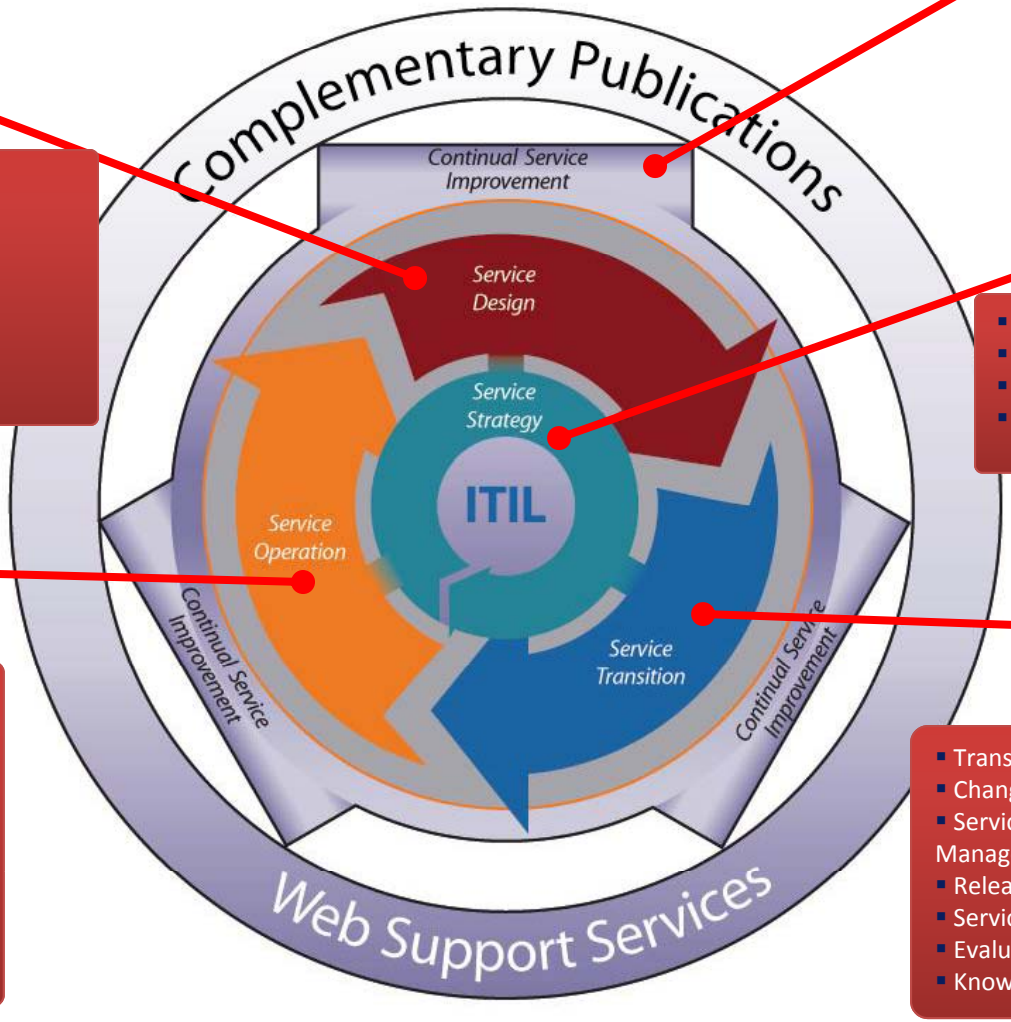


- Strategy Generation
- Financial Management
- Service Portfolio Management
- Demand Management

- **Service Desk**
- **Incident Management**
- Event Management
- **Request Fulfilment**
- **Problem Management**
- Access Management
- Technical Management
- IT Operations Management
- Application Management



- Transition Planning & Support
- Change Management
- Service Asset & Configuration Management
- Release & Deployment Management
- Service Validation & Testing
- Evaluation
- Knowledge Management



How to Work With the Information Systems Service Desk

Following the service desk process helps employees and the organization. Here's how:

These are typical ways to initiate help requests.

Self-service Portal http://www... | Walk-up | Phone | Email

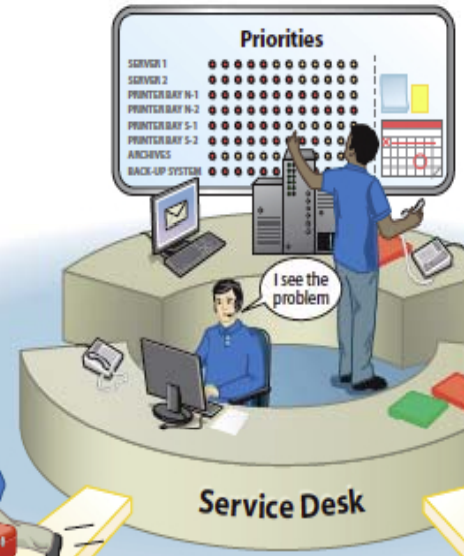
To: ServiceDesk@yourcompany.com
Re: Urgent hardware issue

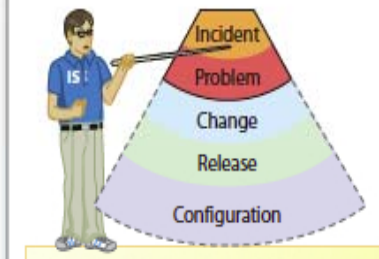
I am unable to connect to server and have a project due in 1 hour!!!

1. Notify IS via one of these four methods & indicate urgency
2. Describe problem

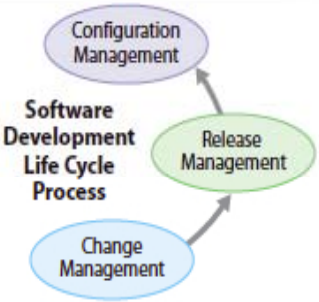
Your organization may differ.

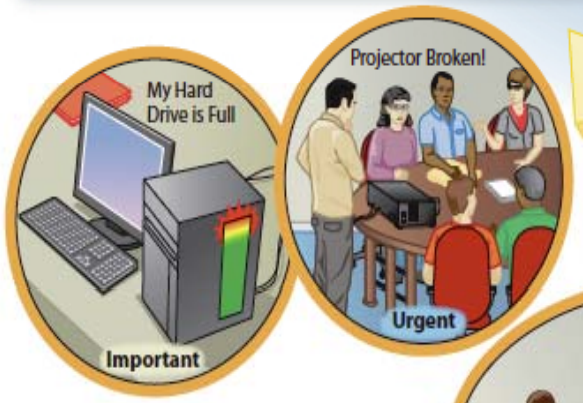
3. Within 8 business hours (or faster based on urgency) a service desk technician will contact you to begin resolution
4. You will be notified via phone for urgent requests





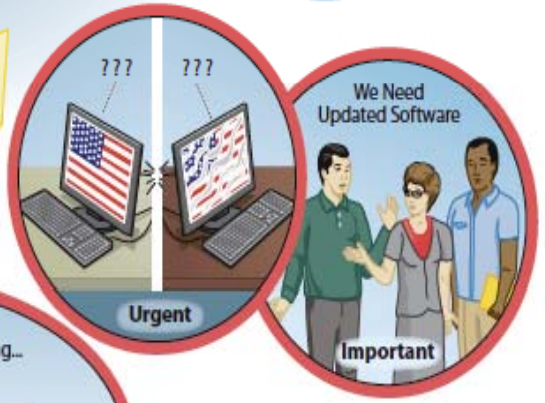
Incident and Problem Management are the two most visible IS Department functions





Incident Management
Isolated occurrences that are addressed with point solutions

Problem Management
Systemic issues that require a coordinated response



ITIL® is the most widely accepted approach to IT service management in the world. ITIL provides a cohesive set of best practice, drawn from the public and private sectors internationally. www.itil-officialsite.com/

We support understanding and business change.

4 Service Operation processes

The processes listed in paragraph 2.4.5 are discussed in detail in this chapter. As a reference, the overall structure is briefly described here and then each of the processes is described in more detail later in the chapter. Please note that the roles for each process and the tools used for each process are described in Chapters 6 and 7 respectively.

- **Event Management** is the process that monitors all events that occur through the IT infrastructure to allow for normal operation and also to detect and escalate exception conditions.
- **Incident Management** concentrates on restoring the service to users as quickly as possible, in order to minimize business impact.
- **Problem Management** invo
  determine and resolve the c
  incidents, proactive activities
  future problems/incidents a
  process to allow quicker dia
  further incidents do occur.

  NOTE: Without this distinctio
  problems, and keeping sepa
  Records, there is a danger t
  - Incidents will be closed t
    support cycle and there
    prevent recurrence – so
    have to be fixed over and over again, or

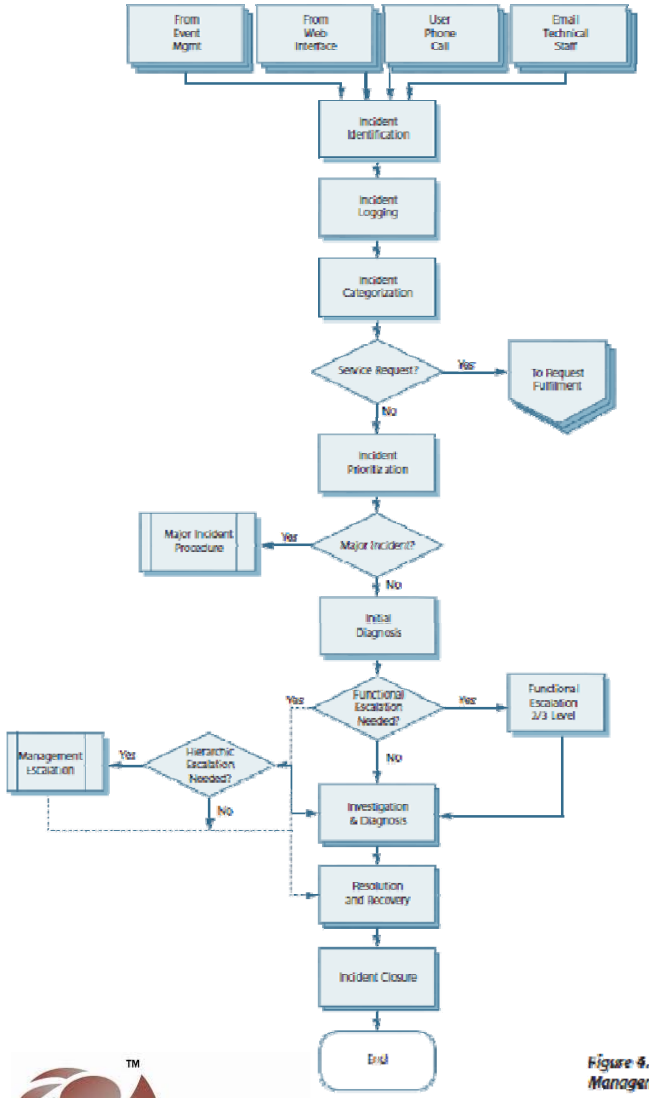


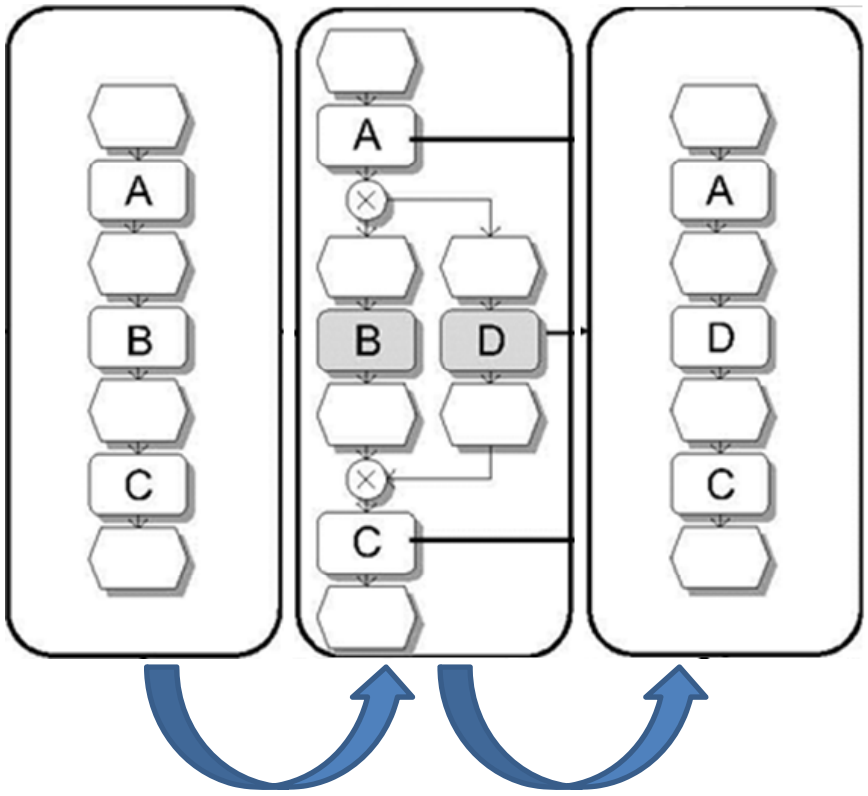
Figure 4.2 Incident Management process flow

ITIL®

Process Compliance

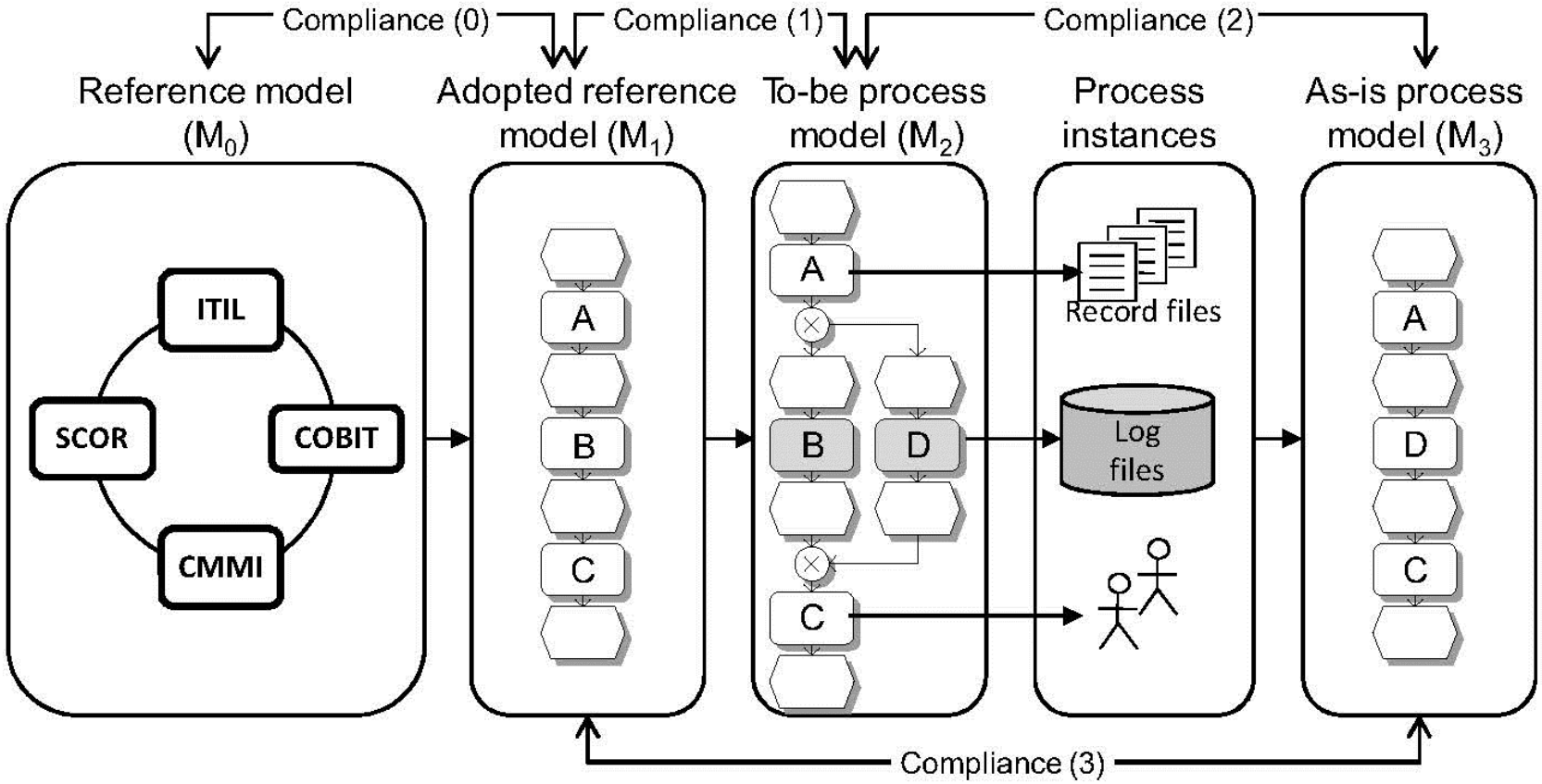
- The degree to which the execution of a process model behaves in accordance to a reference model

- It complies with laws, regulations and contractual arrangements

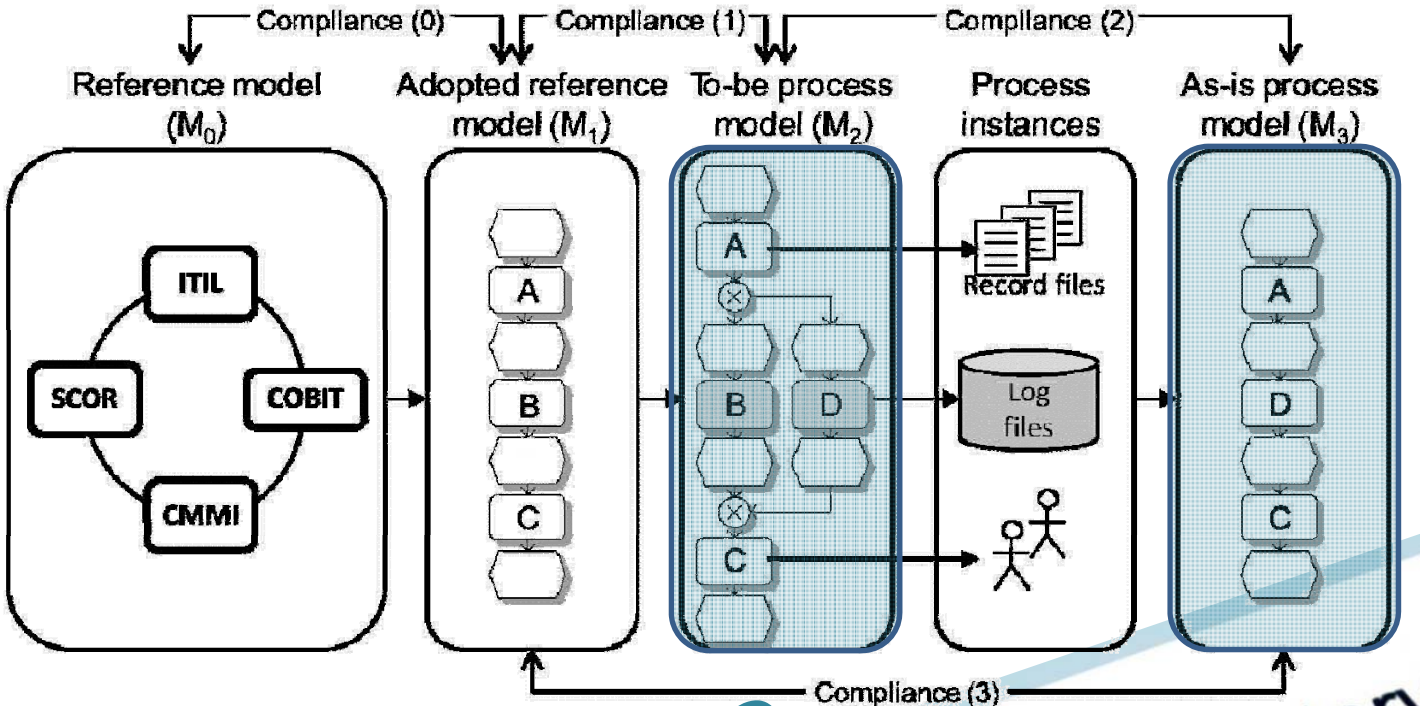


Gerke, K.; Cardoso, J. and Claus, A. Measuring the Compliance of Processes with Reference Models. In 17th International Conference on Cooperative Information Systems (CoopIS 2009), Springer, Algarve, Portugal, 2009.

The methodology identifies 5 entities, illustrated in Fig. 1, which need to be considered when measuring the compliance with reference models: the meta reference model M_0, the adopted reference model M_1, the to-be process model M_2, the instances of a process model M_2, and the as-is process model M_3.

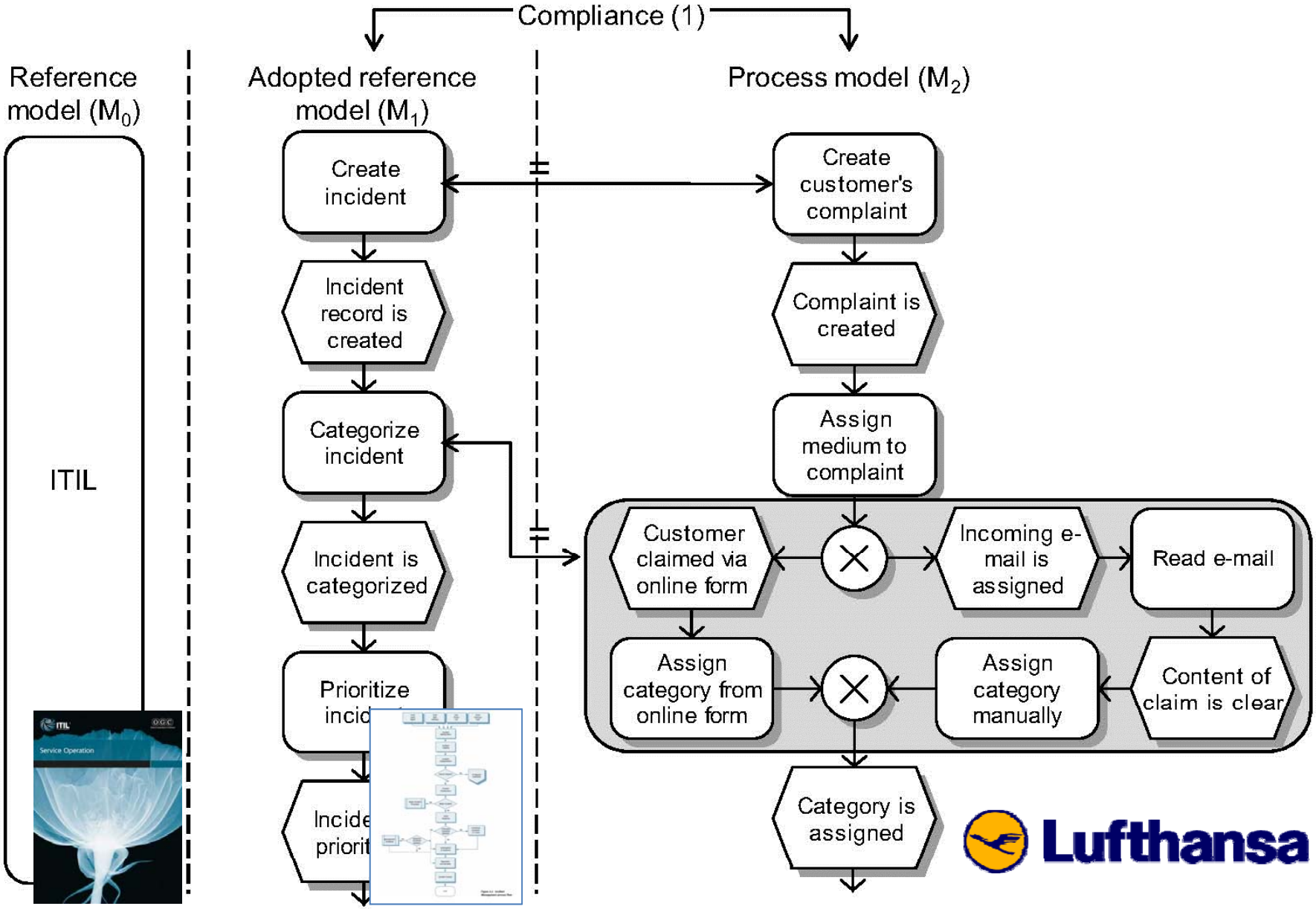


Model M_1 and M_2 are mainly constructed manually, whereas M_3 is usually inferred from log files.


Compliance (0)
Compliance (1)
Compliance (2)
Reference model (M_0)
Adopted reference model (M_1)
To-be process model (M_2)
Process instances
As-is process model (M_3)
ITIL
SCOR
COBIT
CMMI
A
B
C
D
Record files
Log files
Compliance (3)

Compliance

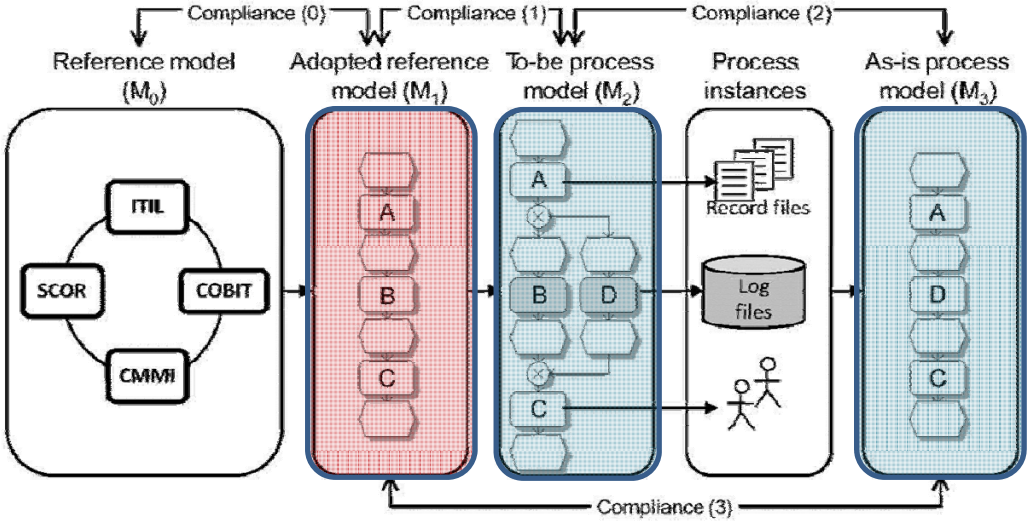

Audit satisfactory
Observa ns made
Nonconfo ces found


Compliance (1)
Reference model (M_0)
Adopted reference model (M_1)
Process model (M_2)
ITIL
Create incident
Incident record is created
Categorize incident
Incident is categorized
Prioritize incid
Incide priorit
Create customer's complaint
Complaint is created
Assign medium to complaint
Customer claimed via online form
Incoming e-mail is assigned
Read e-mail
Assign category from online form
Assign category manually
Content of claim is clear
Category is assigned
Lufthansa

Sequence-based Compliance

- Measure the compliance of model M2 or M3 with M1
- Two models can have different structures but the algorithm can still judge processes to be compliant

Factors: Granularity, Maturity, Degree, Iteration, etc.



Find the greater similarity of transitions of σ_1 and σ_2.

– *The* firing sequence compliance (fsc) *of* σ_2 *w.r.t.* σ_1 *is:*

$$\mathrm{fsc}(\sigma_2, \sigma_1, \mathcal{P}, \mathcal{G}) = \max\{\mathrm{lcs}(s, s') | s \in \sigma_1^{\mathrm{ext}}(\mathcal{P}), s' \in \sigma_2^{\mathrm{map}}(\mathcal{G})\} \ . \quad (1)$$

σ_2 are executed according to the reference model expressed with σ_1

– *The* firing sequence compliance degree (fscd) *of* σ_2 *w.r.t.* σ_1 *is:*

$$\mathrm{fscd}(\sigma_2, \sigma_1, \mathcal{P}, \mathcal{G}) = \frac{\mathrm{fsc}(\sigma_2, \sigma_1, \mathcal{P}, \mathcal{G})}{|\sigma_2|_{\mathrm{map}}} \ . \quad (2)$$

the specification of a reference model σ_1 is followed by σ_2.

– *The* firing sequence compliance maturity (fscm) *of* σ_2 *w.r.t.* σ_1 *is:*

$$\mathrm{fscm}(\sigma_2, \sigma_1, \mathcal{P}, \mathcal{G}) = \frac{\mathrm{fsc}(\sigma_2, \sigma_1, \mathcal{P}, \mathcal{G})}{|\sigma_1|_{\mathrm{ext}}} \ . \quad (3)$$

– *The* compliance degree (cd) *of* M_2 *w.r.t.* M_1 *is given by:*

The ratio of instances, which can be produced by one

$$\mathrm{cd}(M_2, M_1, \mathcal{P}, \mathcal{G}) = \frac{\sum_{\sigma_2 \in S'(M_2)} \max_{\sigma_1 \in S'(M_1)} \{\mathrm{fscd}(\sigma_2, \sigma_1, \mathcal{P}, \mathcal{G})\}}{|S'(M_2)|} \ . \quad (4)$$

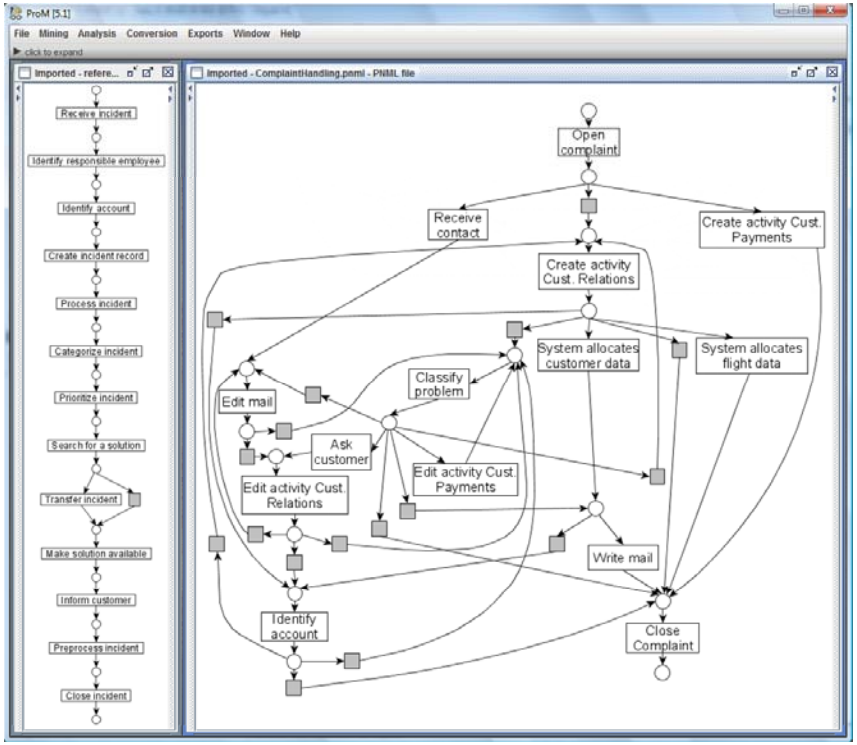
model that can also be produced by the other model.

– *The* compliance maturity (cm) *of* M_2 *w.r.t.* M_1 *is given by:*

$$\mathrm{cm}(M_2, M_1, \mathcal{P}, \mathcal{G}) = \frac{\sum_{\sigma_1 \in S'(M_1)} \max_{\sigma_2 \in S'(M_2)} \{\mathrm{fscm}(\sigma_2, \sigma_1, \mathcal{P}, \mathcal{G})\}}{|S'(M_1)|} \ . \quad (5)$$

Industrial Application

- The left-hand side
  - Reference model M1
  - Adopted from ITIL
  - Initially created as an EPC in ARIS
  - Converted into a WF-net
  - Imported into ProM
- The right-hand side
  - As-is model M3
  - Complaint handling process of the passenger airline.
  - Extracted with the ProM plugin "Heuristic Miner"
  - Log file with 4,650 cases and 44,006 events being observed over a period of one year.

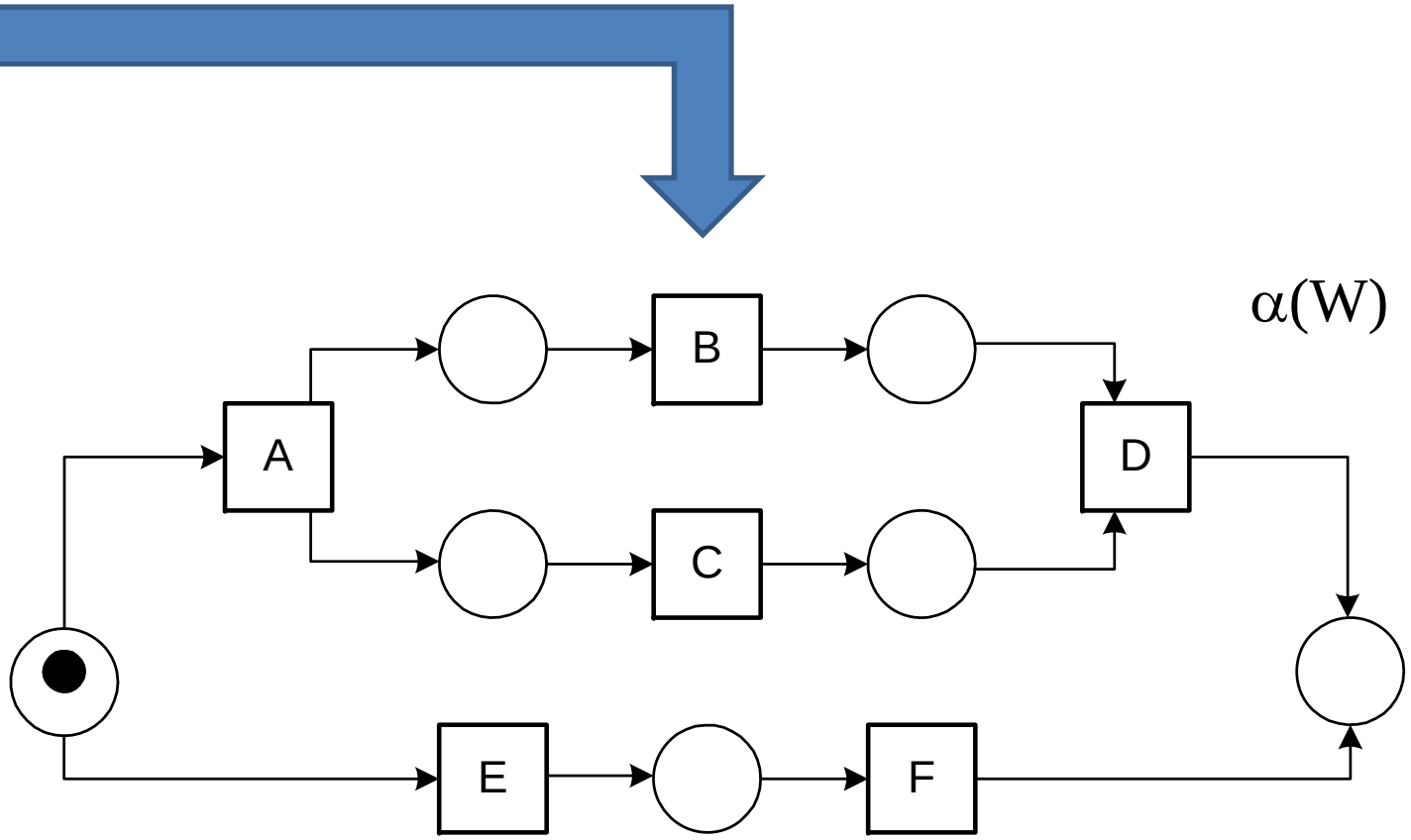


ProM Tool

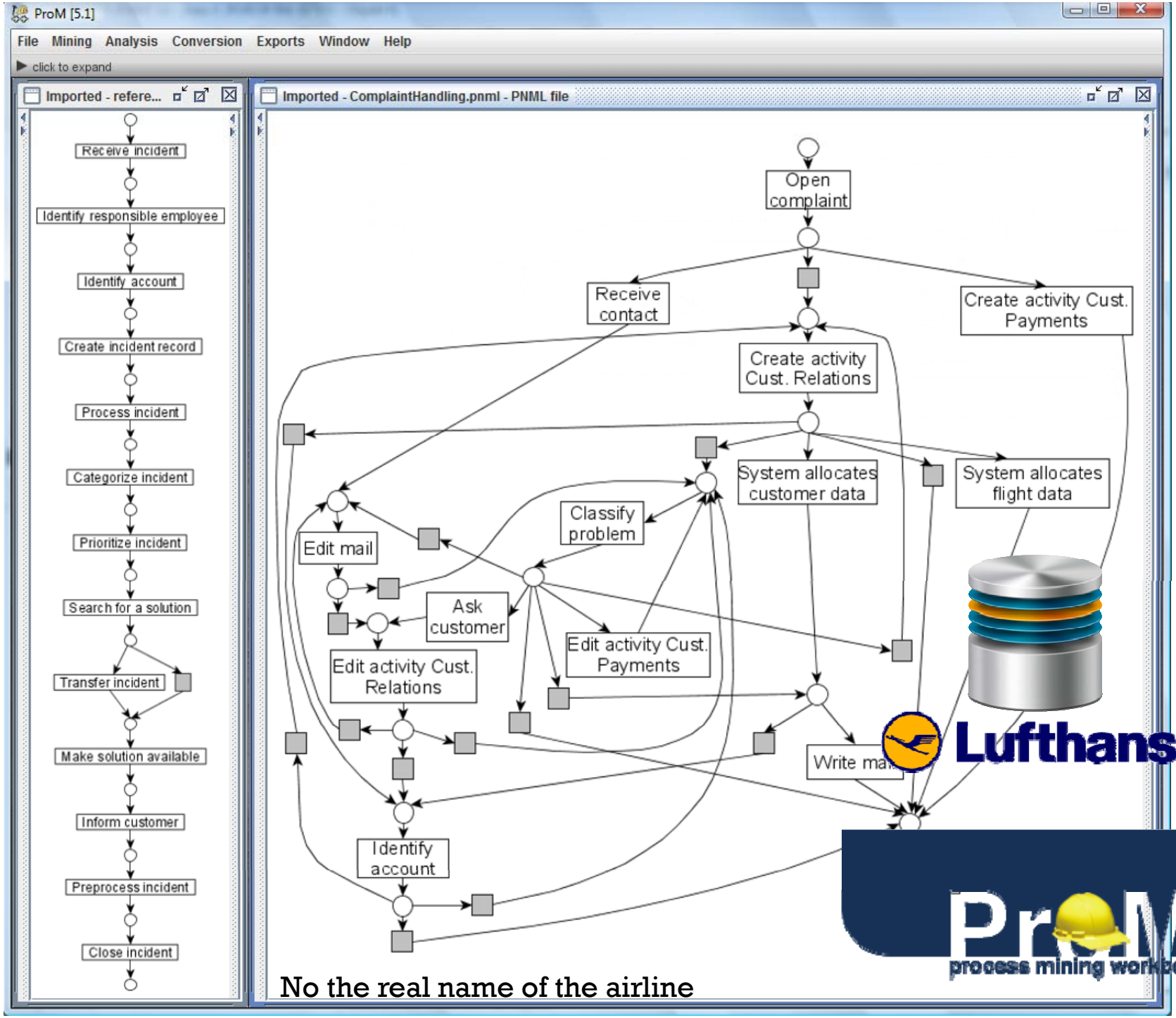
Process Mining

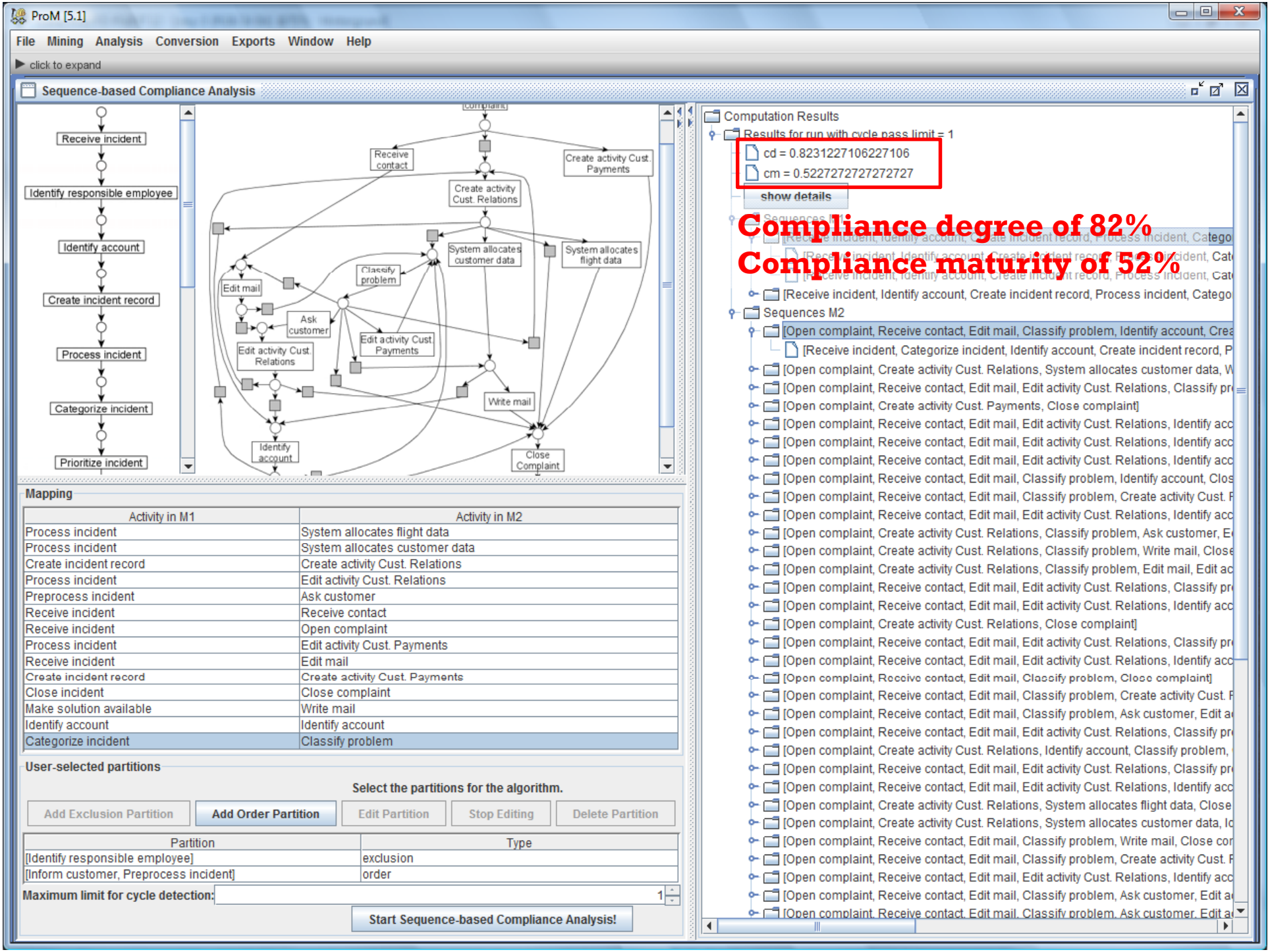
W

case 1 : task A
case 2 : task A
case 3 : task A
case 3 : task B
case 1 : task B
case 1 : task C
case 2 : task C
case 4 : task A
case 2 : task B
case 2 : task D
case 5 : task E
case 4 : task C
case 1 : task D
case 3 : task C
case 3 : task D
case 4 : task B
case 5 : task F
case 4 : task D



From Aalst, Process Mining: Discovering processes from event logs


ProM [5.1]
File Mining Analysis Conversion Exports Window Help
click to expand
Imported - refere...
Receive incident
Identify responsible employee
Identify account
Create incident record
Process incident
Categorize incident
Prioritize incident
Search for a solution
Transfer incident
Make solution available
Inform customer
Preprocess incident
Close incident
Imported - ComplaintHandling.pnml - PNML file
Open complaint
Receive contact
Create activity Cust. Payments
Create activity Cust. Relations
System allocates customer data
System allocates flight data
Classify problem
Edit mail
Ask customer
Edit activity Cust. Relations
Edit activity Cust. Payments
Write mail
Identify account
Lufthansa
ProM
process mining workbench
No the real name of the airline


ProM [5.1]
File Mining Analysis Conversion Exports Window Help
click to expand
Sequence-based Compliance Analysis
Receive incident
Identify responsible employee
Identify account
Create incident record
Process incident
Categorize incident
Prioritize incident
Receive contact
Create activity Cust. Payments
Create activity Cust. Relations
System allocates customer data
System allocates flight data
Classify problem
Edit mail
Ask customer
Edit activity Cust. Relations
Edit activity Cust. Payments
Write mail
Identify account
Close Complaint
Mapping
Activity in M1 | Activity in M2
Process incident | System allocates flight data
Process incident | System allocates customer data
Create incident record | Create activity Cust. Relations
Process incident | Edit activity Cust. Relations
Preprocess incident | Ask customer
Receive incident | Receive contact
Receive incident | Open complaint
Process incident | Edit activity Cust. Payments
Receive incident | Edit mail
Create incident record | Create activity Cust. Payments
Close incident | Close complaint
Make solution available | Write mail
Identify account | Identify account
Categorize incident | Classify problem
User-selected partitions
Select the partitions for the algorithm.
Add Exclusion Partition
Add Order Partition
Edit Partition
Stop Editing
Delete Partition
Partition | Type
[Identify responsible employee] | exclusion
[Inform customer, Preprocess incident] | order
Maximum limit for cycle detection: 1
Start Sequence-based Compliance Analysis!
Computation Results
Results for run with cycle pass limit = 1
cd = 0.8231227106227106
cm = 0.5227272727272727
show details
Compliance degree of 82%
Compliance maturity of 52%
Sequences M2
[Open complaint, Receive contact, Edit mail, Classify problem, Identify account, Crea
[Receive incident, Categorize incident, Identify account, Create incident record, P
[Open complaint, Create activity Cust. Relations, System allocates customer data, W
[Open complaint, Receive contact, Edit mail, Edit activity Cust. Relations, Classify pr
[Open complaint, Create activity Cust. Payments, Close complaint]
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[Open complaint, Create activity Cust. Relations, Classify problem, Write mail, Close
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[Open complaint, Receive contact, Edit mail, Classify problem, Ask customer, Edit a

Interpretation of Results

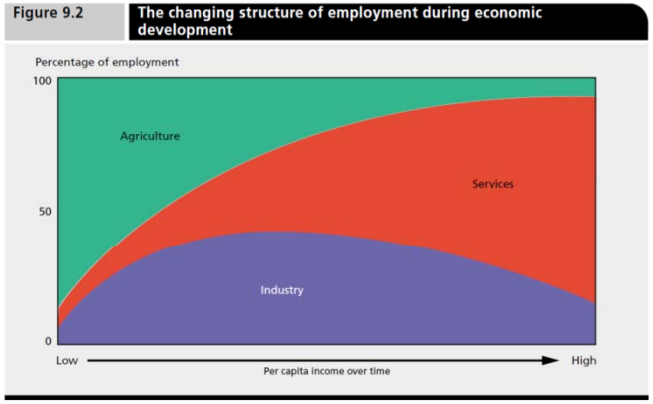
- Compliance degree of 82%
  - Indicates that the processes executed by the airline correspond to the recommendations of the reference model.
  - Although the models *M*3 and *M*1 look different, the model *M*3 is highly compliant with reference model *M*1.

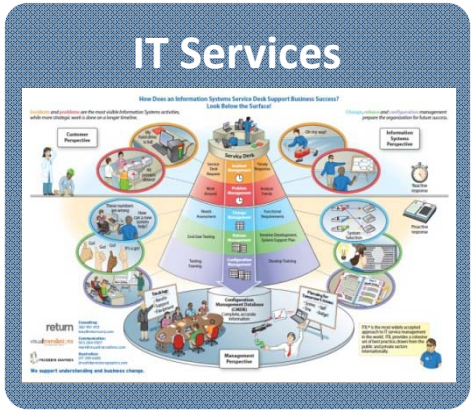
- The compliance maturity of 52%
  - Indicates that there are recommendations in reference model *M*1 which are not implemented by the airline.
  - Nonetheless, because of the maturity value of 52% we can conclude that model *M*3 is also partially mature with reference model *M*1.

The Importance of Services

Service economies

Self-services



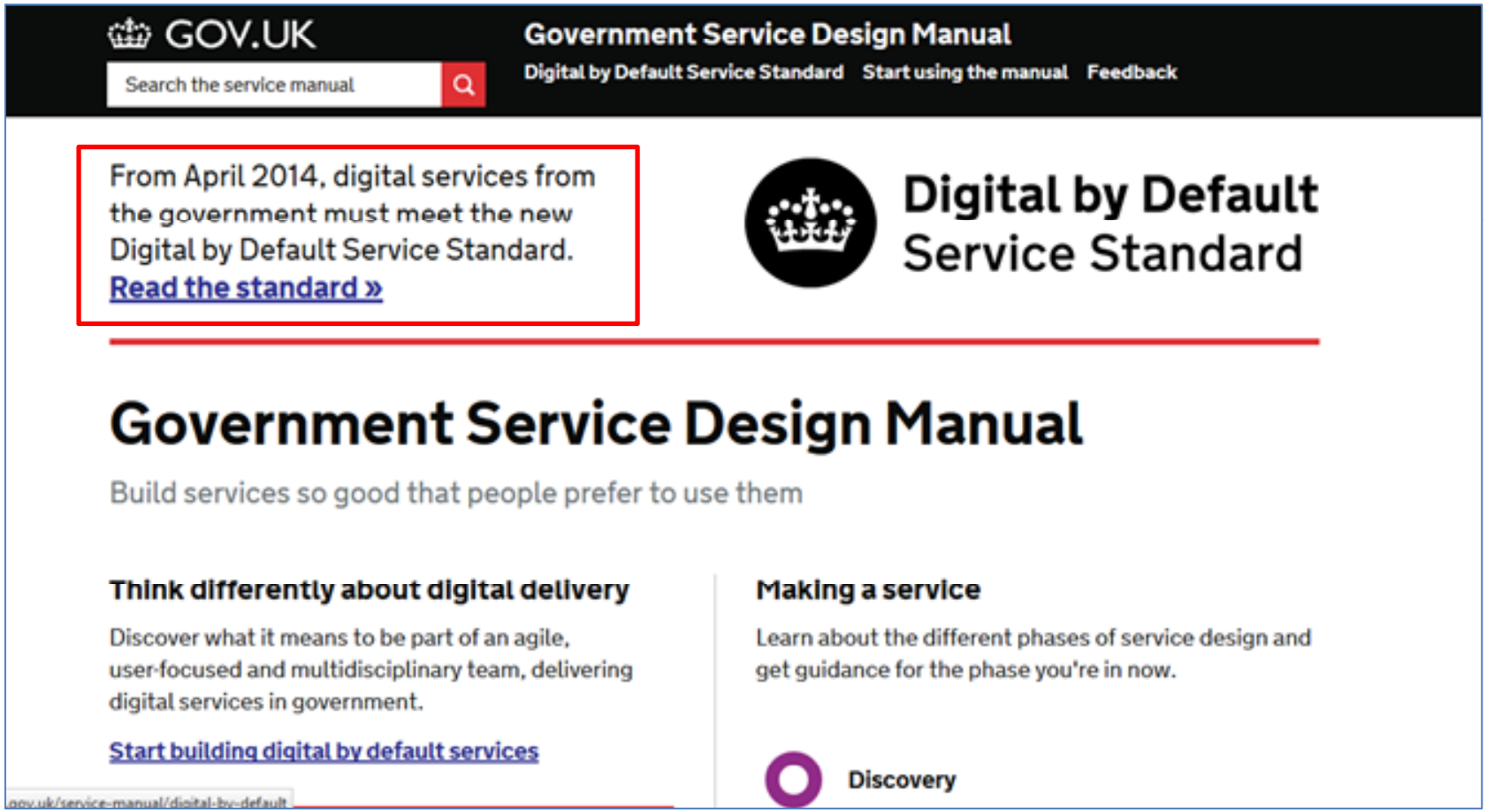


Manual

Semi-automatic

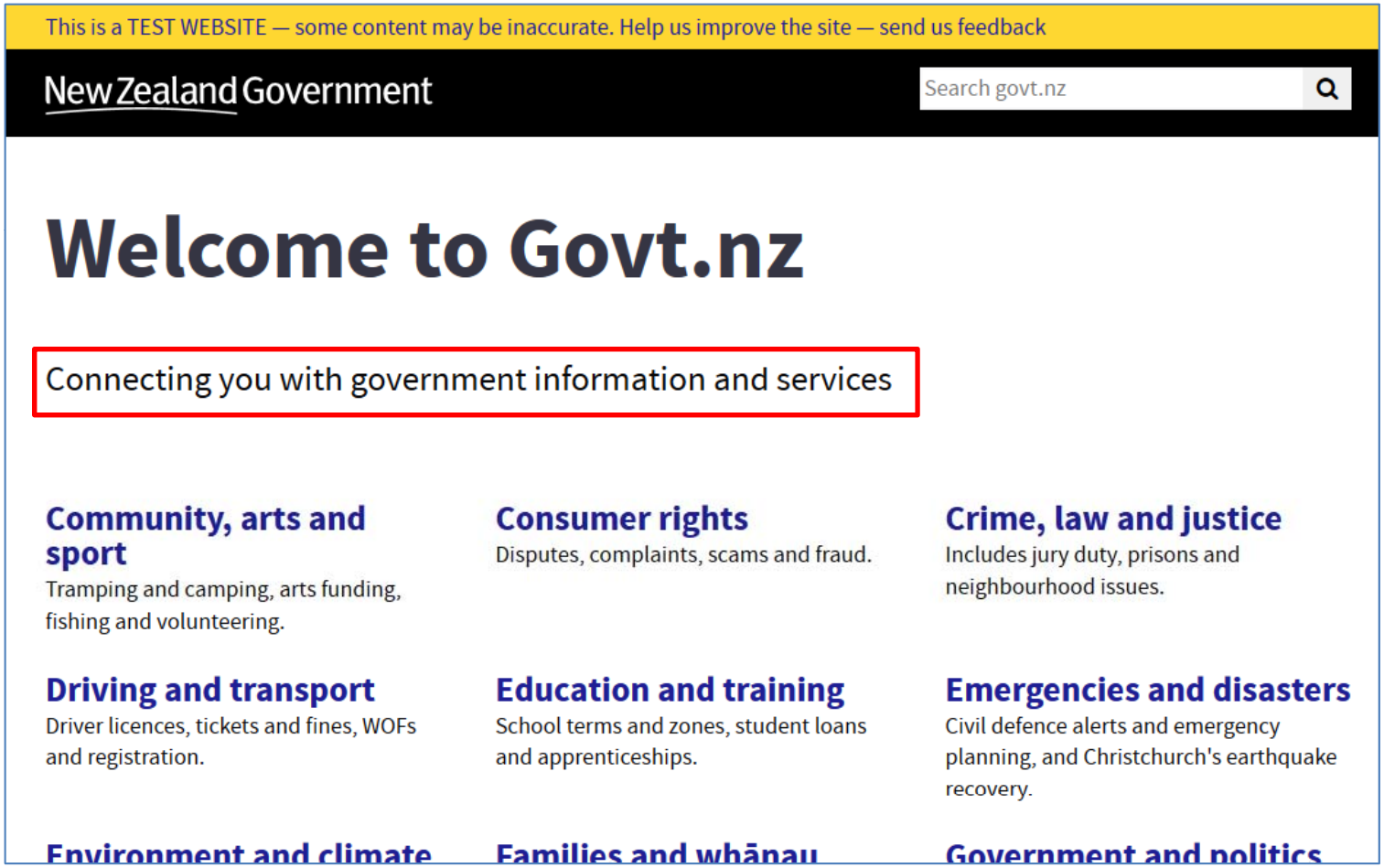
Fully Automated

Digital Services

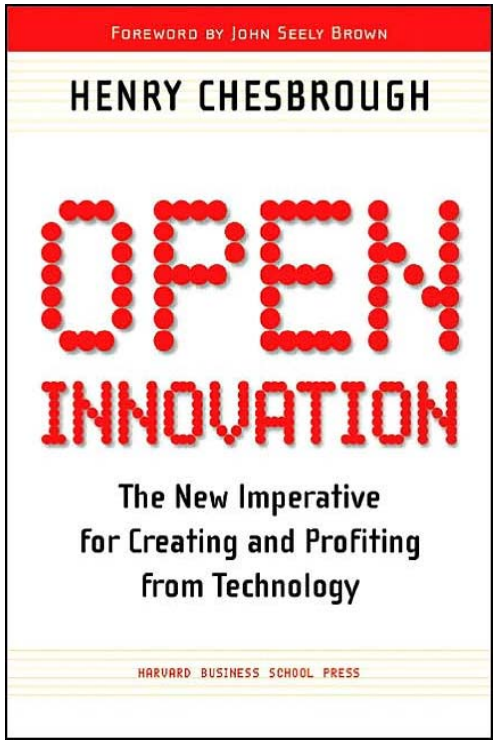


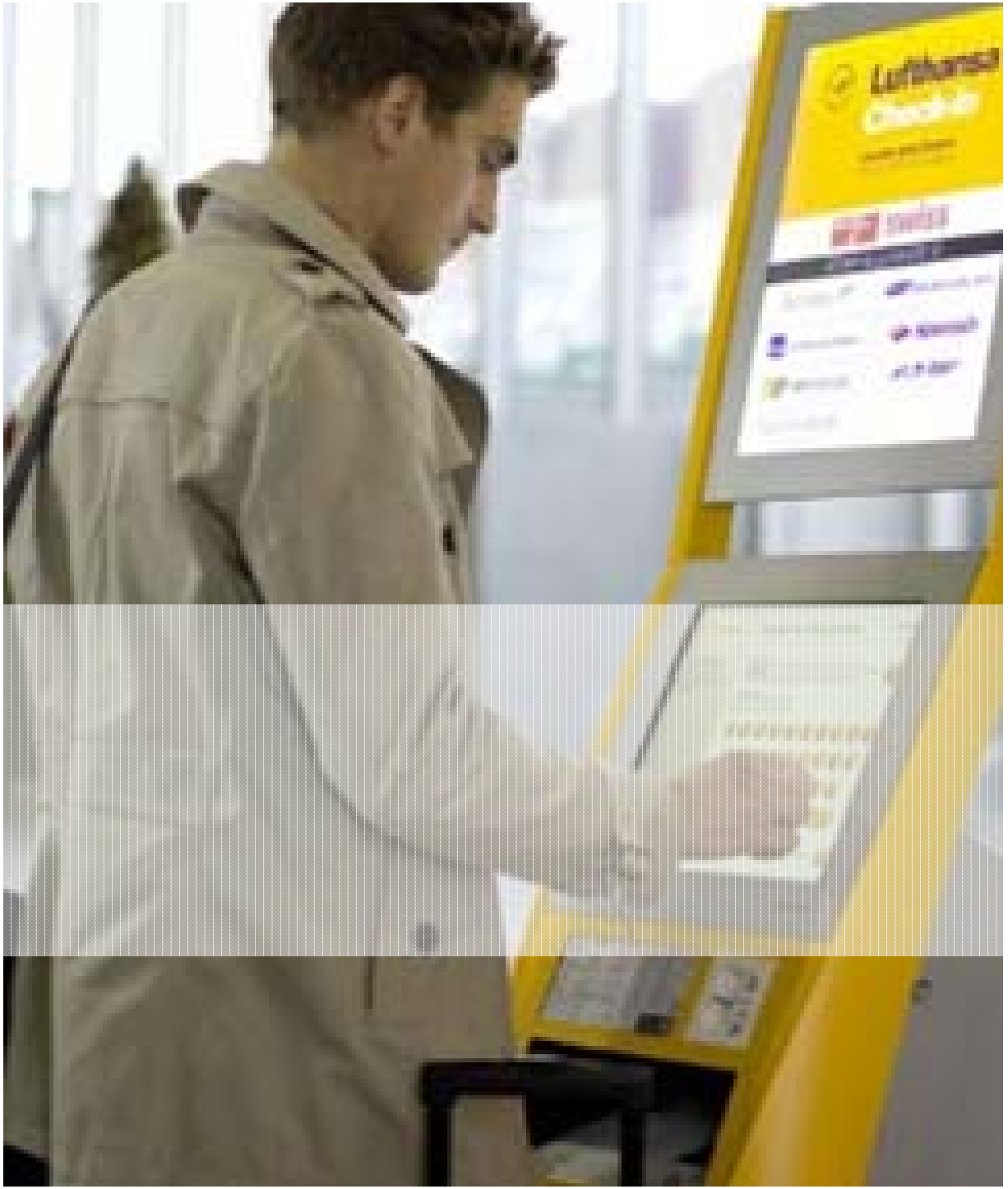
https://www.gov.uk/service-manual

Digital Services



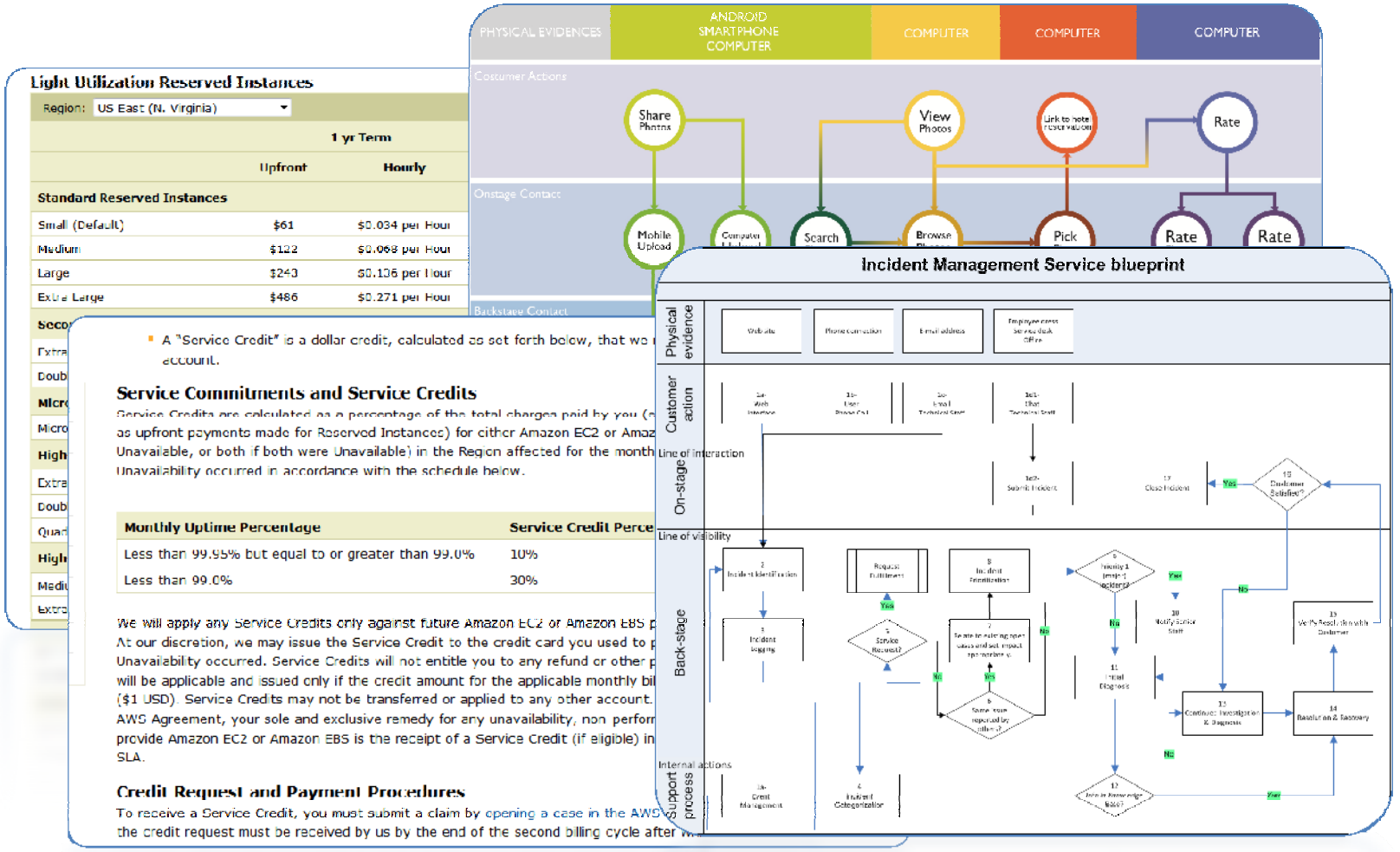
The Open Paradigm





How are Services Described?

Fragmented Information

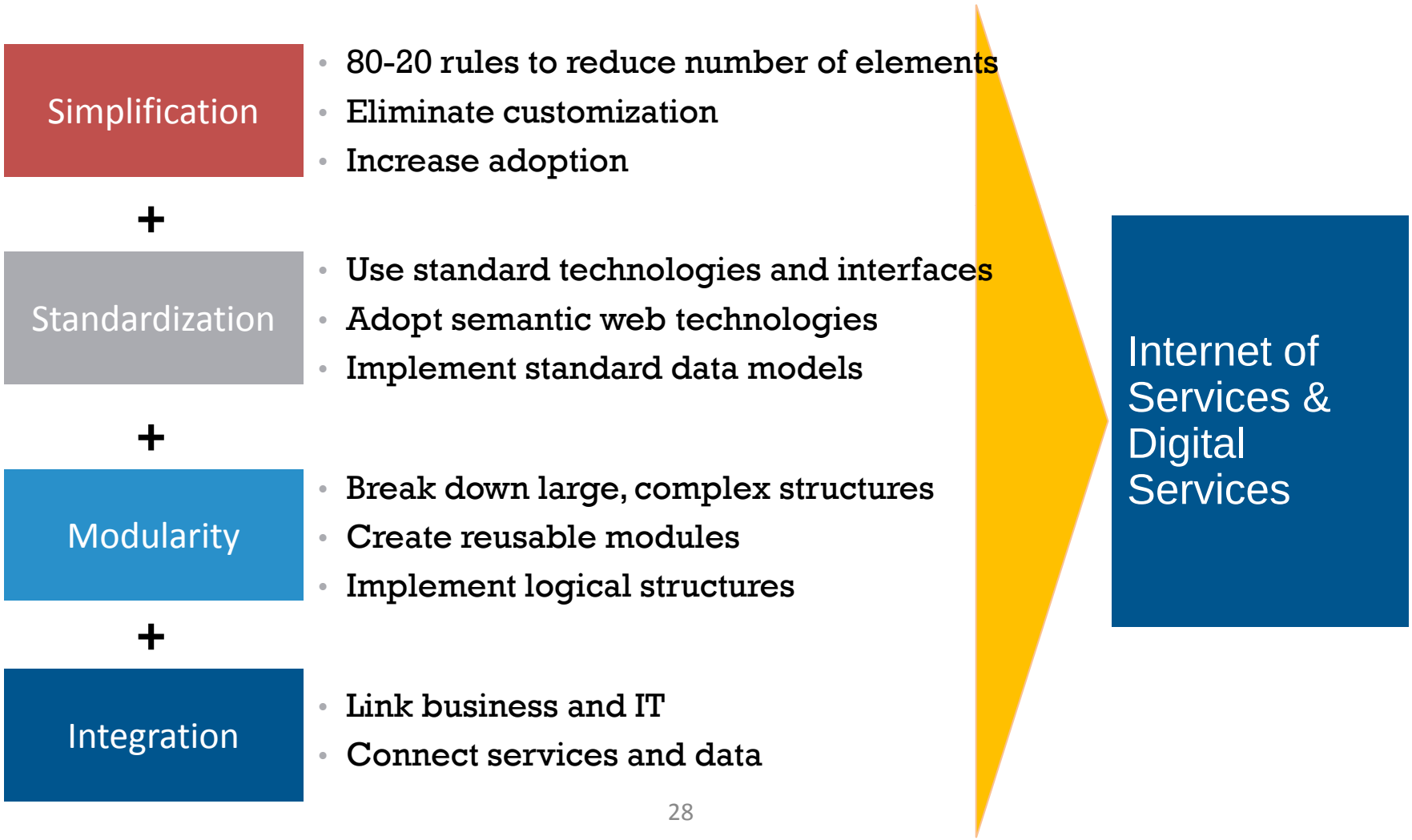


Open Services

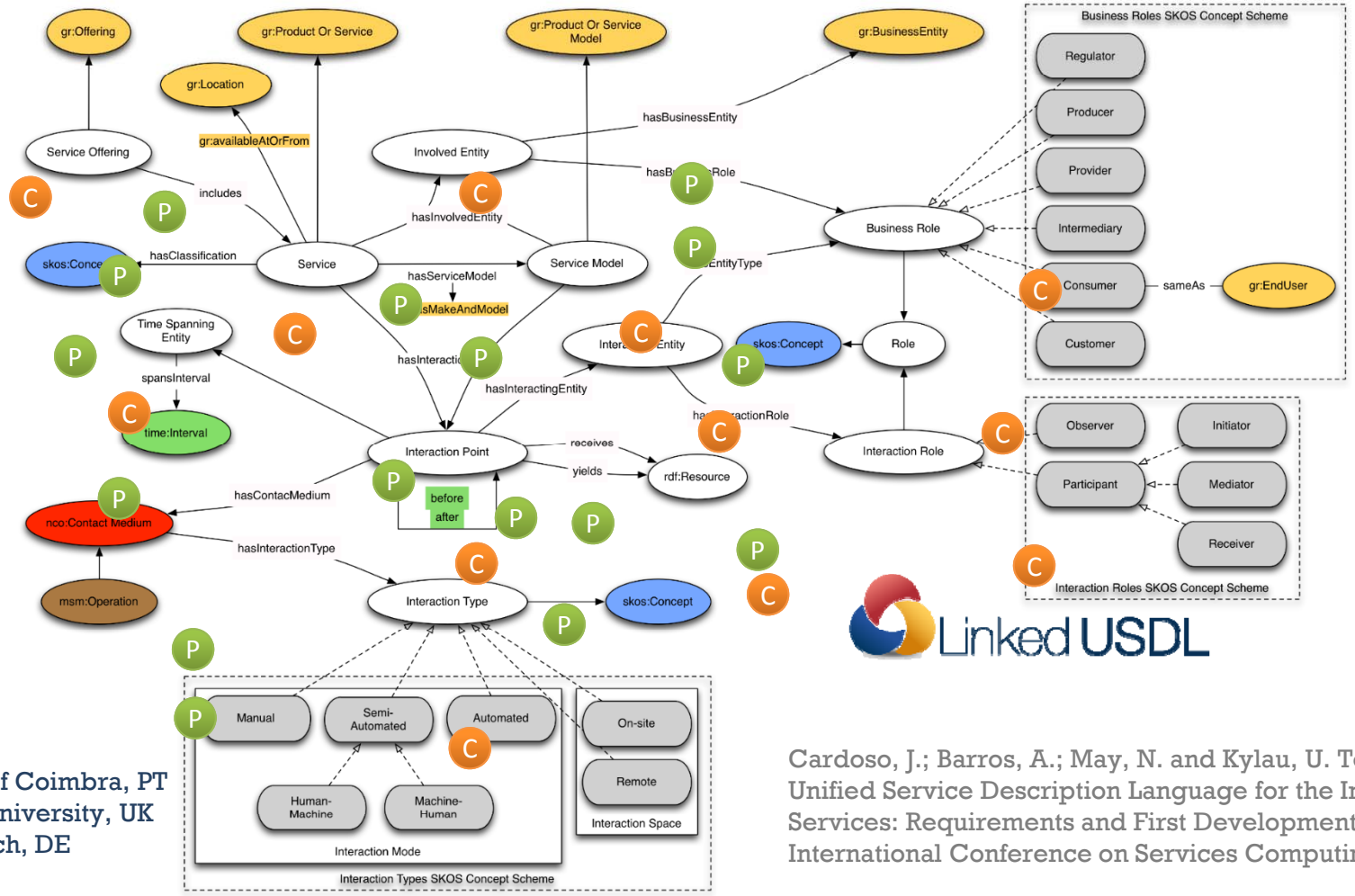
Linked USDL

- **U**nified **S**ervice **D**escription **L**anguage
- Existing methods do not conceptualize the service system, the object of service analytics
- Provides technical and additionally operational perspective (ownership and provisioning, pricing and legal) on services
- Uses a "master schema " for services to describe various types of services professional to electronic services
- Provides wide range of concepts usable for costing e.g. core, pricing, service level and legal

Linked USDL design principles



Linked USDL Core (2013)

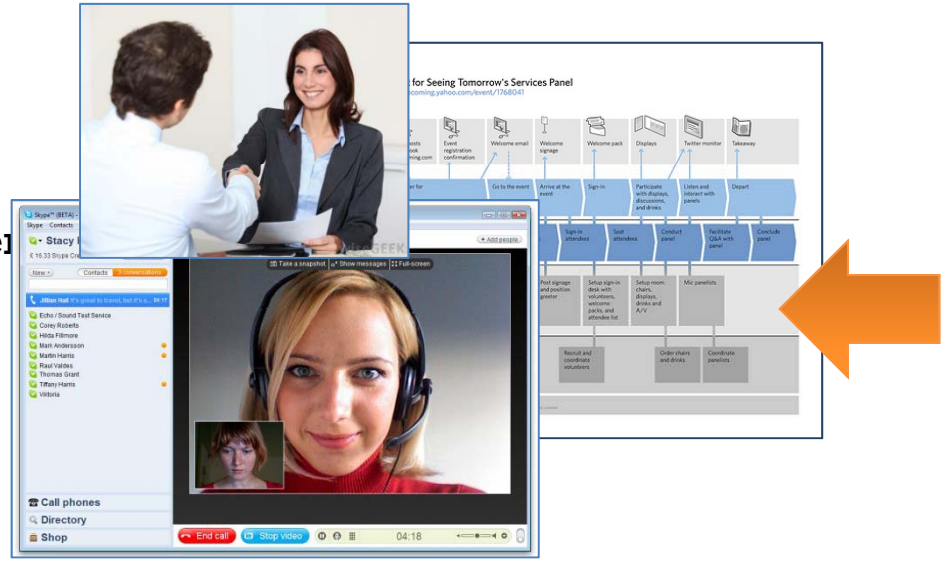


University of Coimbra, PT
The Open University, UK
SAP Research, DE

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 Value Proposition

- Improve the efficiency of the organization, IT staff and IT customers
- Improve the effectiveness of services
- Global overview of service portfolios
- Improve the ability of the technology to automate services
- Enable better measurement and control of service delivery and meet SLA

Linked USDL Pricing (2013)

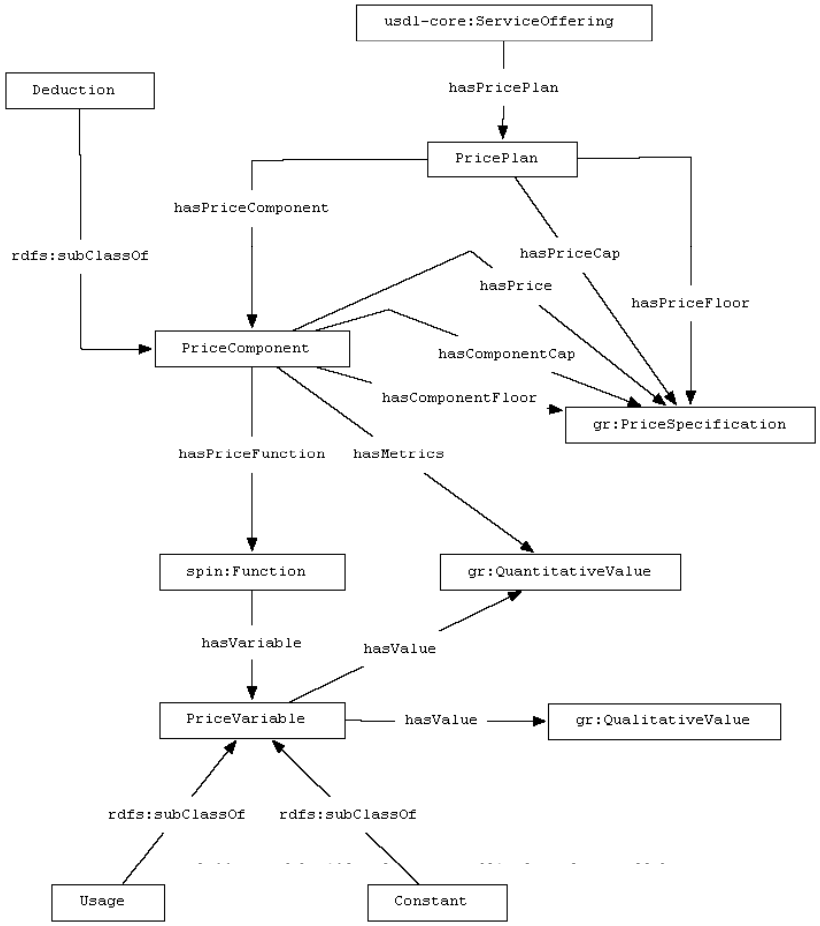
- On-Demand Instances
- Reserved Instances
- Reserved Instance Volume Discounts
- Spot Instances
- Data Transfer
- EBS-Optimized Instances
- Amazon Elastic Block Store
- Elastic IP Addresses
- Amazon CloudWatch
- Auto Scaling
- Elastic Load Balancing
- AWS GovCloud Region

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	$0.100 per Hour
Extra Large	$486	$0.271 per Hour	$758	$0.215 per Hour
Second Generation Standard Reserved Instances				
Extra Large	$517	$0.209 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	$0.109 per Hour	$398	$0.130 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



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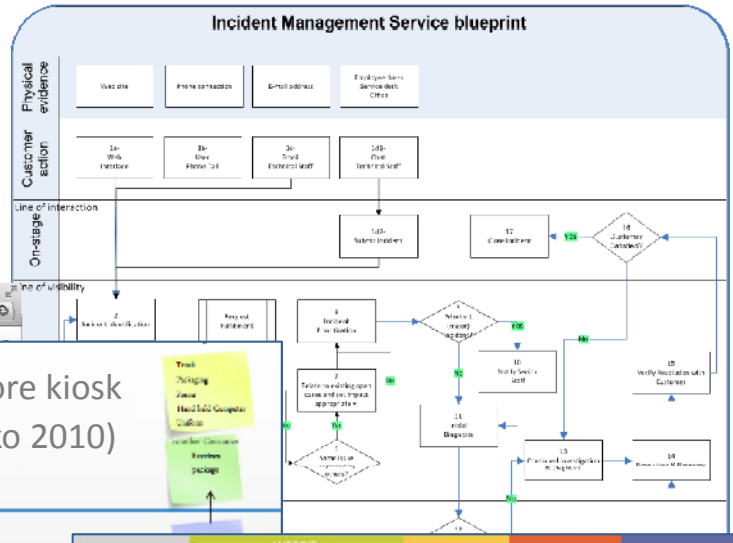
SAP Research, DE

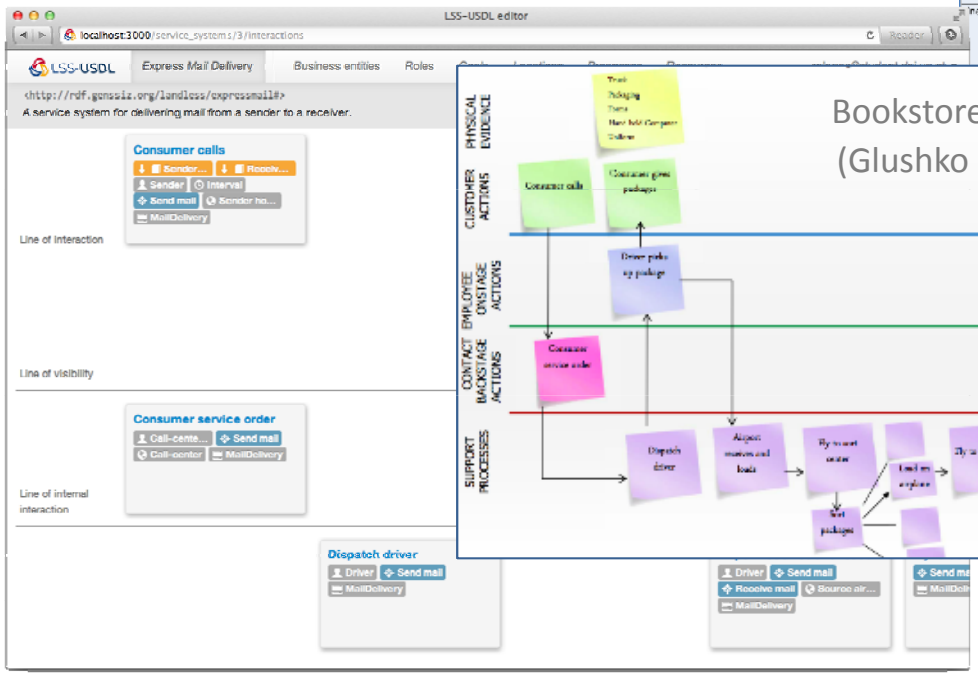
Service Systems

LSS-USDL

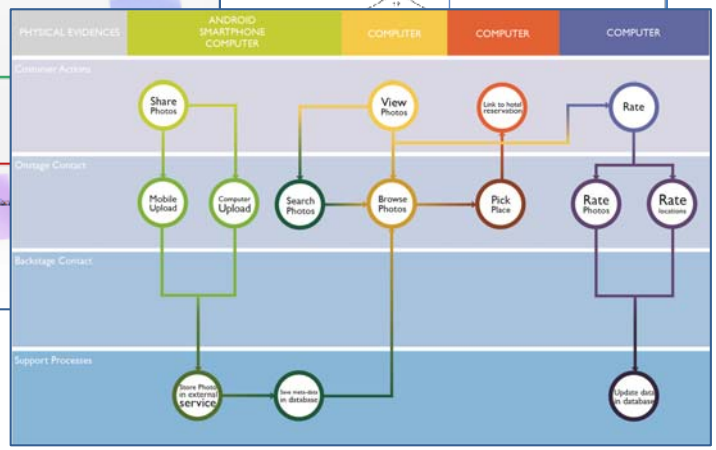
- Service System model
  - Computer-understandable and processable model

ITIL Incident Management





Bookstore kiosk
(Glushko 2010)

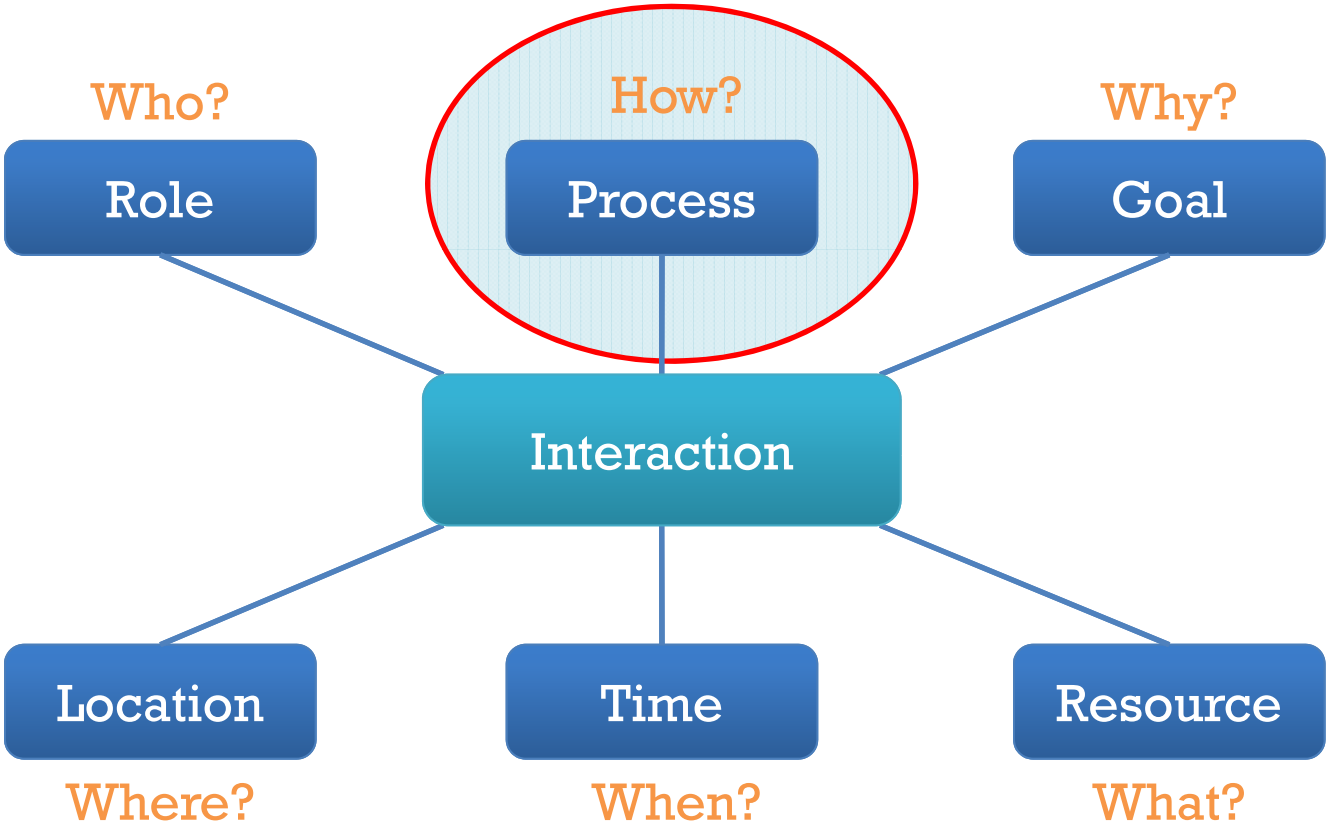


Express mail delivery
(Gremler 2011)

University of Coimbra, PT
Gent University, BE

SaaS webapp
(Lopes et al. 2012)

Components of a Service



Open Service Representation

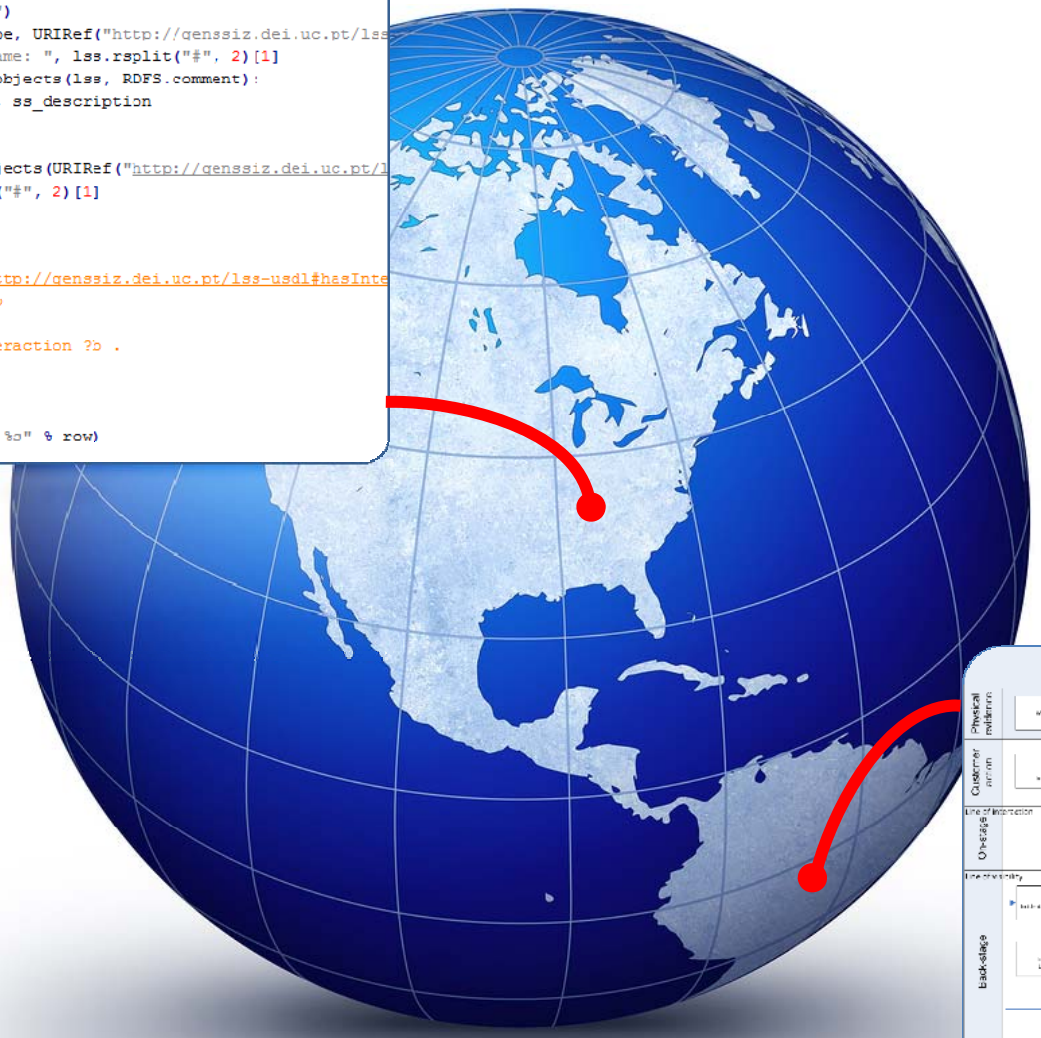
```
@prefix : <http://genssiz.org/lss-usdl/expressmail#>
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix lss-usdl: <http://genssiz.dei.uc.pt/lss-usdl#> .

:ExpressMailDelivery a lss-usdl:ServiceSystem;
  rdfs:label "Express Mail Delivery";
  rdfs:comment "A service system for delivering express mails";
  lss-usdl:hasInteraction :CustomerCalls,
    :CustomerDeliversPackages .

:CustomerCalls a lss-usdl:CustomerInteraction;
  rdfs:label "Customer calls";
  lss-usdl:hasGoal :SendMail;
  lss-usdl:isPerformedBy :Sender;
  lss-usdl:hasLocation :SenderHome .

:CustomerDeliversPackages a lss-
usdl:CustomerInteraction;
  rdfs:label "Customer delivers packages";
  lss-usdl:isPerformedBy :Sender .

:SendMail a lss-usdl:Goal;
  rdfs:label "Send mail" .

:Sender a lss-usdl:Role;
  rdfs:label "Sender" .

:SenderHome a lss-usdl:Location;
  rdfs:label "Sender's home" .
```

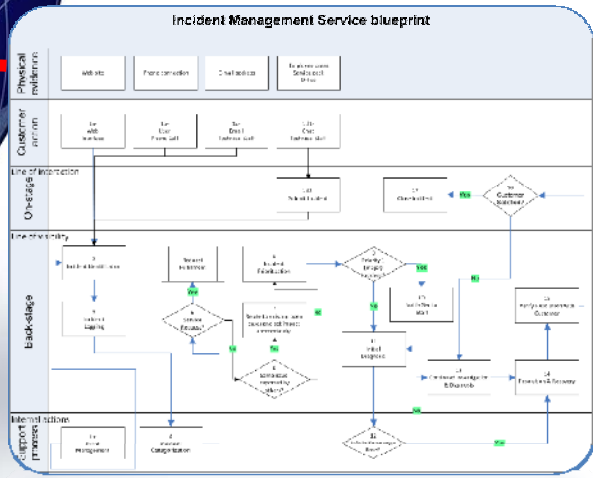
Open Service Queries

- Identify hidden patterns associated with costs for usdl concept usdl:InteractionPoints: who, how and what:
- Who (CQ1). Who is involved during the provisioning of a service or a particular interaction point?
- How (CQ2). How is an interaction conducted?
- What (CQ3). What resources were used during interactions?

Wolfgang Seiringer, Jorge Cardoso, Johannes Kunze von Bischhoffshausen, Service System Analytics: Cost Prediction, (PRO-VE'13) 14TH IFIP Working Conference on Virtual Enterprises, 30 Sep- 2 Oct 2013, Dresden, Germany.

```
from rdflib import Graph, Literal, BNode, RDF, URIRef,  RDFS
from rdflib.namespace import FOAF, DC
import rdflib

    g = Graph()
    g.parse("https://raw.github.com/rplopes/lss-usdl/master/use%20cases/

    print("--- printing LSS  ---")
    for lss in g.subjects(RDF.type, URIRef("http://genssiz.dei.uc.pt/lss
        print "Service Ssystem Name: ", lss.rsplit("#", 2)[1]
        for ss_description in g.objects(lss, RDFS.comment):
            print "Description:", ss_description

    print "Interaction Points: "
    for sub, obj in g.subject_objects(URIRef("http://genssiz.dei.uc.pt/l
        interaction = obj.rsplit("#", 2)[1]
        print interaction

    qres = g.query(
        """PREFIX  lss-usdl:  <http://genssiz.dei.uc.pt/lss-usdl#hasInte
            SELECT DISTINCT ?a ?b
            WHERE {
              ?a lss-usdl:hasInteraction ?b .
            }""")

    for row in qres:
        print("%s hasInteraction %s" % row)
```





Open Service Queries

```
PREFIX usdl: <http://www.linked-usdl.org/ns/usdl-core>
prefix gr: <http://purl.org/goodrelations/v1>
PREFIX rdf:http://www.w3.org/1999/02/22-rdf-syntax-ns#

SELECT ?ip ?interactionRole
WHERE{
  ?service gr:name ?name .
  ?service usdl:hasInteractionPoint ?ip
  ?ip usdl:hasInteractingEntity ?ie .
  ?ie usdl:hasEntityType ?businessRol
  ?ie usdl:hasInteractionRole ?interact
  FILTER regex(?name, "Maintenance"
}
```

Query selects all `interactionPoints` associated with „`Maintenance`“

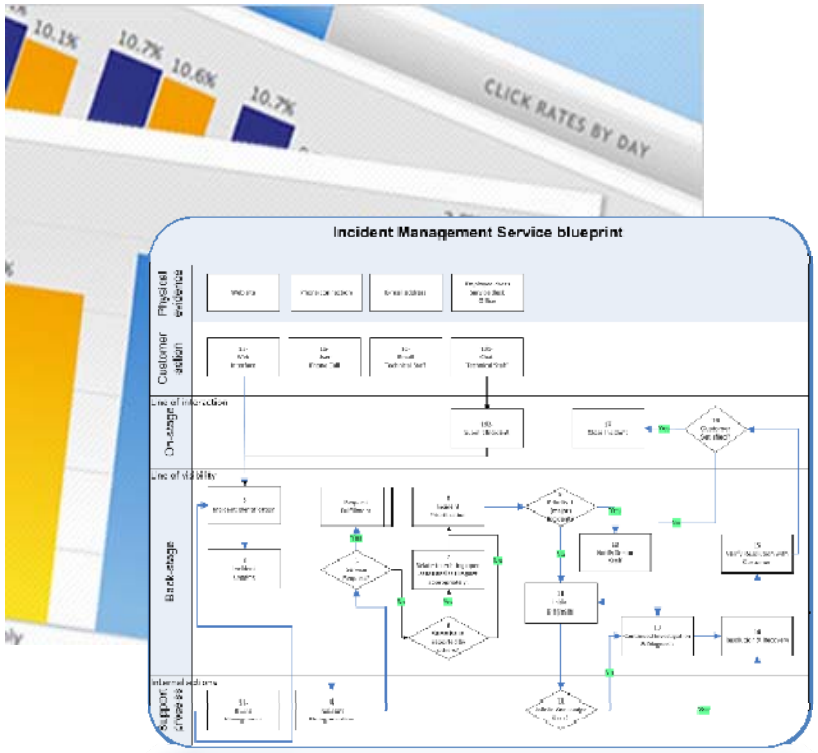
The obtained result provides input for methods of service analytics

Can be extended to other LINK USDL elements

Remote Service Querying

Open Service Queries

- Percentage of major incidents
- Mean elapsed time to achieve incident resolution or circumvention, broken down by impact code
- Percentage of incidents incorrectly categorized
- Number and percentage the of incidents processed per Service Desk agent
- Number and percentage of incidents resolved remotely, without the need for a visit
- Breakdown of incidents by time of day, to help pinpoint peaks and ensure matching of resources.

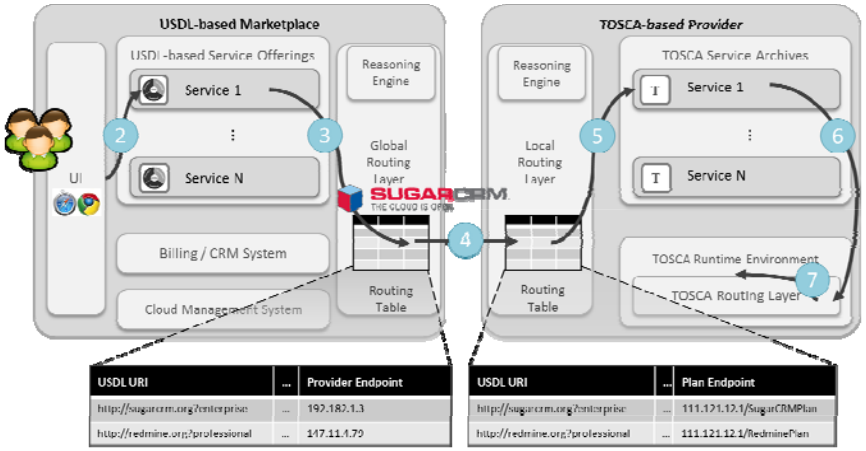


Query Process Execution Metrics

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

USDL & TOSCA Integration

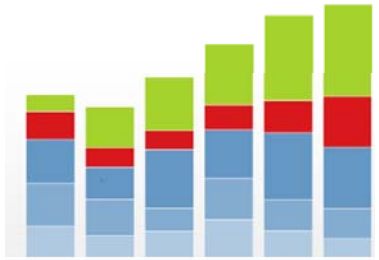


Linked Open Data Integration

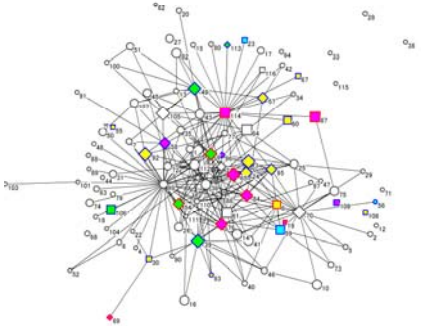
Linked USDL

Next Steps (2014)

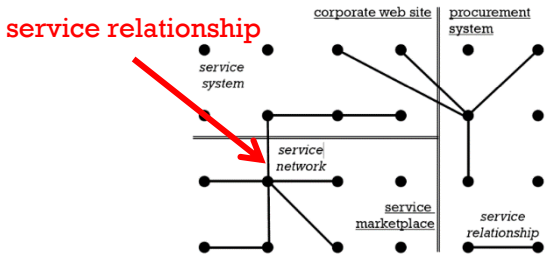
- Service Analytics
  - Service system mining
  - Process mining
  - Data mining



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

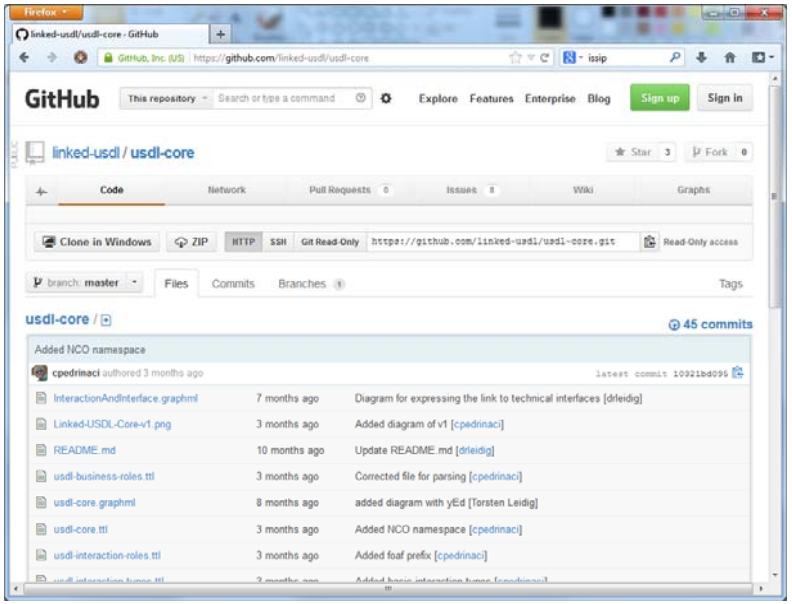


- Service Relationships
  - Evidence from Social Networks
  - Text mining techniques
  - Co-occurance analysis



Resources

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



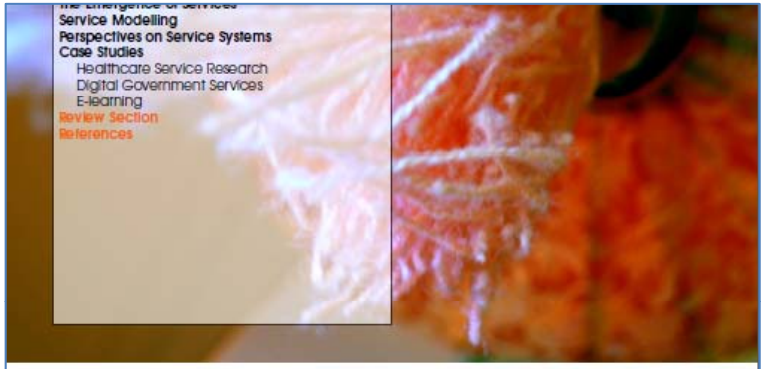
https://github.com/linked-usdl/
https://github.com/Genssiz/lss-usdl

Useful links

- LSS-USDL Editor: Open source repository of the LSS-USDL graphical editor.
- USDL Incubator Group: LSS-USDL is part of the research for service systems by the USDL research group.
- Linked USDL: Similar project, focusing on service descriptions for customers. The third use case found in LSS-USDL's repository shows a service system modeled both in LSS-USDL and Linked USDL.
- Linked USDL core: Repository for the core module of Linked USDL. The other modules may be found under the same Github profile.
- Semantic Web: Technologies such as RDF are a core component of LSS-USDL.

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.

Conclusions

- Business Process Outsourcing (BPO)
  - Often use reference models (e.g. ITIL)
  - Models are customized and adapted
  - Require methods to verify compliance
- Open Services
  - Require formal descriptions (e.g. Linked USDL)
  - Capture the underlying process models
  - Require methods to query models and instances
  - Service analytics: smart data from executions

Further Reading

- 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, IEEE Computer Society Press, Florida, USA, 2010.
- Gerke, K.; Cardoso, J. and Claus, A. Measuring the Compliance of Processes with Reference Models. In 17th International Conference on Cooperative Information Systems (CoopIS 2009), Springer, Algarve, Portugal, 2009.
- Cardoso, J.; Pedrinaci, C.; Leidig, T.; Rupino, P. and Leenheer, P. D Foundations of Open Semantic Service Setworks. In International Journal of Service Science, Management, Engineering, and Technology, Vol. 4 (2): 1-16, 2013.
- Cardoso, J. Modeling Service Relationships for Service Networks. In 4th International Conference on Exploring Service Science (IESS 1.3), pages 114-128, Springer, Porto, Portugal, LNBIP, Vol. 143, 2013.
- Cardoso, J. and Miller, J. A Internet-Based Self-Services: from Analysis and Design to Deployment. In The 2012 IEEE International Conference on Services Economics (SE 2012), IEEE Computer Society, Hawaii, USA, 2012.

Thank You *for* Listening