



Web Services Trustworthiness Model

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Agenda

- **Information systems**
 - What they are?
- **Web services**
 - Basic information
- **Context sensitive computing**
 - Examples
- **Trustworthiness**
 - What is it
- **The vision**
 - What is new to be designed



Information systems

The past

- Expensive, standalone systems
- Offline/batch interfaces
- One instance for one business context of use
- Known data suppliers and recipients
- Expensive integrations between systems

The future

- Service Oriented model of use
- On-line interfaces with established format standards
- Dynamic composition of service suppliers and recipients
- Assured technical interoperability

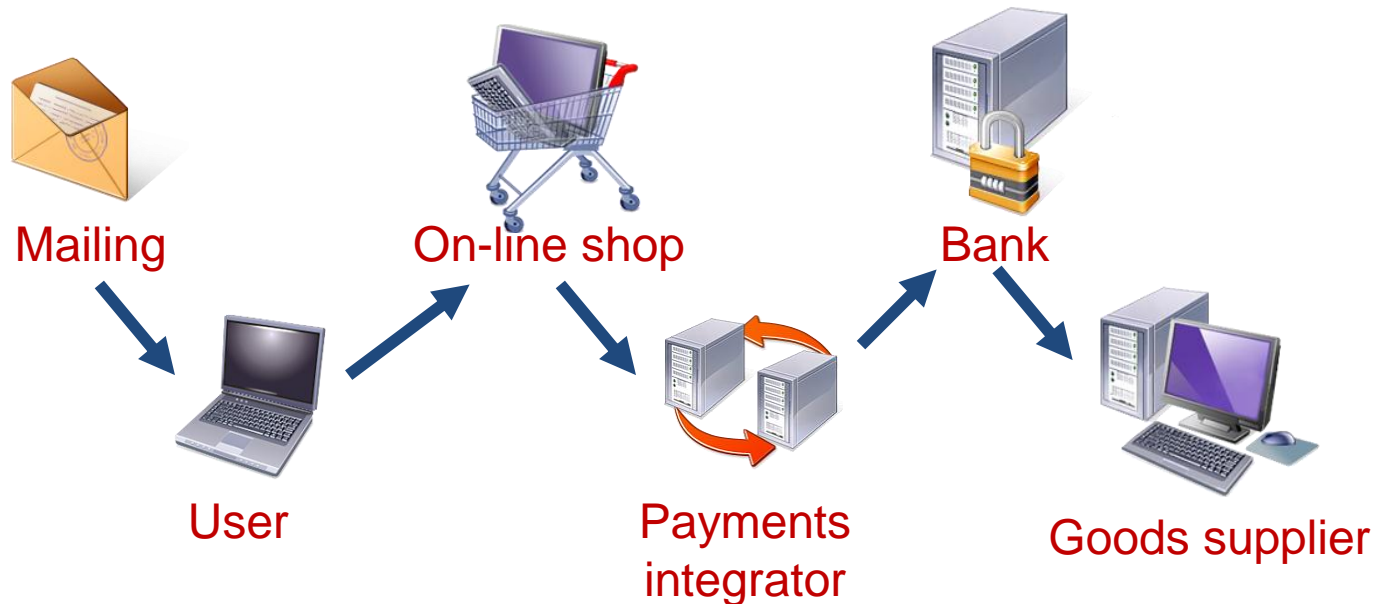
What is „an information system”

- **An information system is:**
 - A set of interconnected components
 - Which has the function of data processing
 - With the use of computation tools
- **The definition reflects legacy systems, does it apply to modern models of use?**



Boundaries of systems

- The boundaries of a legacy system are defined as external interfaces
- Where are boundaries of Service Oriented system?



Responsibility

- The responsibility is defined typically in the context of boundaries and intended purpose of use
- Legacy systems provide the possibility to address responsibility
- What about Service Oriented model?



Web services

- **Advancements in integration processes**

- Organizational (open enterprises)

- Technical (interoperable tools, available free of charge)

- Knowledge (open, relatively simple and widely accepted standards)

- **Impact**

- In EU (enterprises with at least 10 employees):

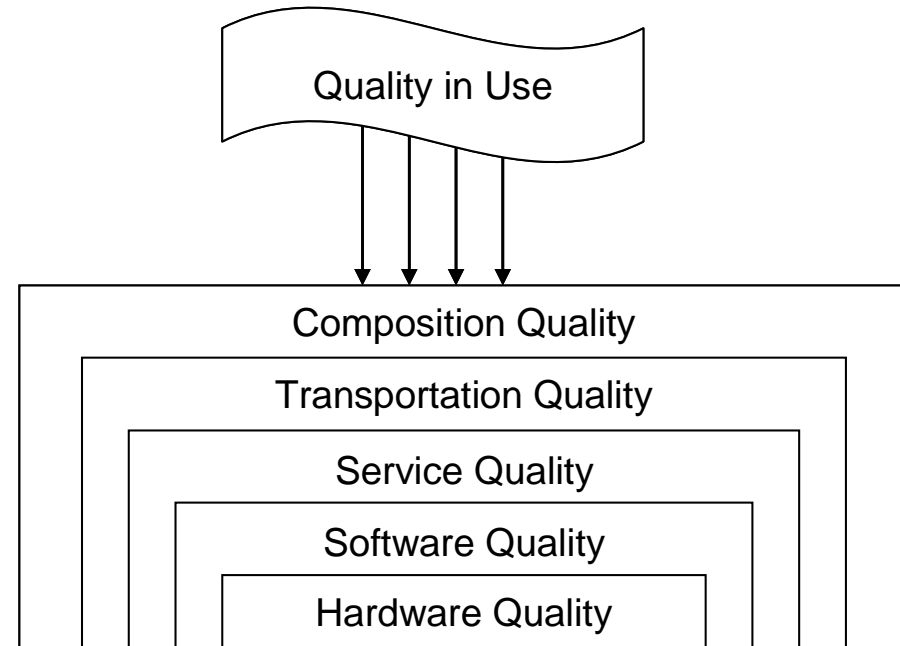
- 41% of enterprises is using automated data exchange with customers or suppliers (34% automatically coordinates supply chain)

- 14% of total enterprises turnover results from sales/purchases by Internet or other networks



Web services quality

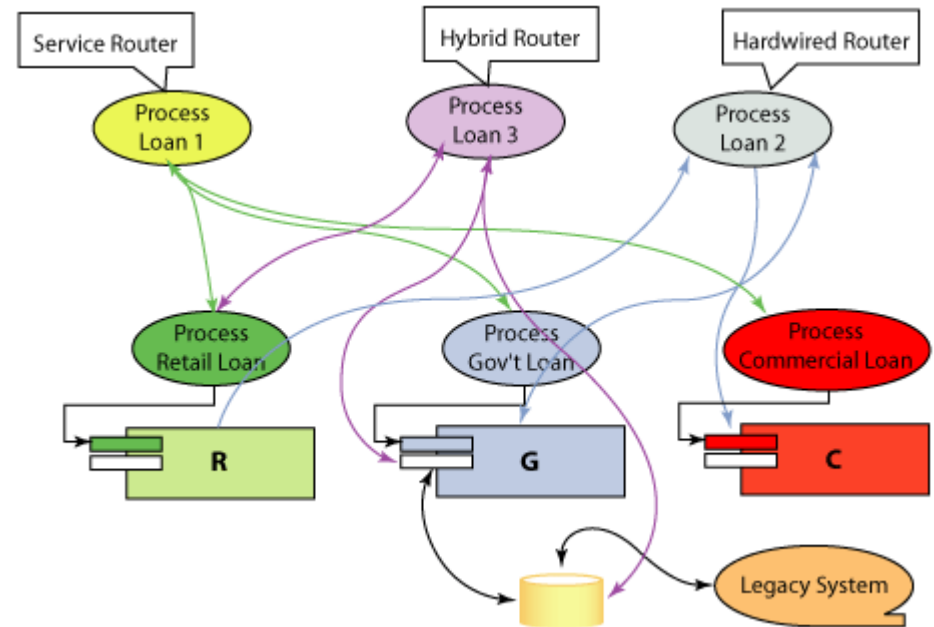
- The quality of a service comprises of several layers of responsibility
- The user requesting a service call is expecting
 - Adequate quality of the call (typically QoS)
 - Relevant outcome (QoR)
- What tools/ideas can support the user?



(Abramowicz, et al. 2009)

Web service selection

- Limitations of service descriptions (WSDL)
- Required enhancements (business oriented information)
 - Real-life results
 - T&C
 - Service level
 - ...
- Limitation of Semantic Web Services (OWL-S, WSMO, SAWSDL)



(IBM, 2005)

Context sensitive computing

- Let us assume:
 - there are two Web Services, each providing weather forecast for geographic location (exemplary call: N: 52° 24' 23", E: 16° 55' 5", Radius: 10 km, Date: 28.10.2011, Hour: 12:00, Forecast: 12h)

there are two customers
 a travel agency
 air-traffic operations centre

both customers are using the same invocation method therefore on the technical level both services are considered to be equivalent

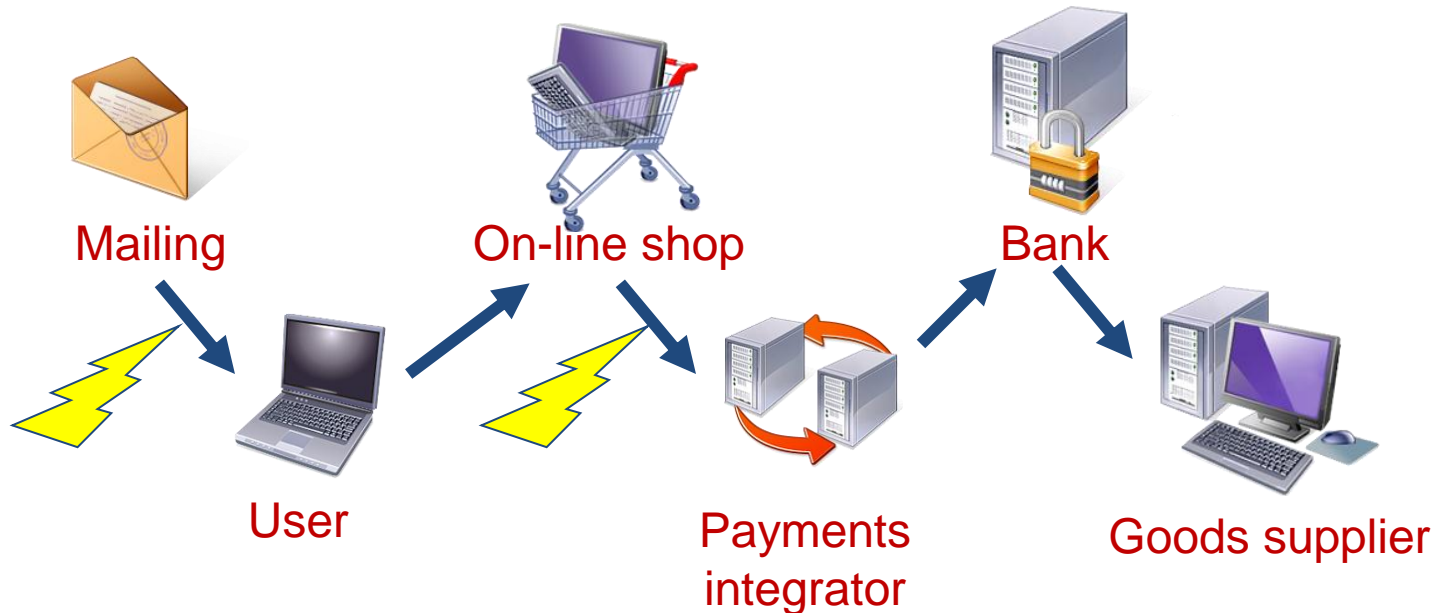
both services are described with all possible tags related to weather forecasting

both providers assure the same level of QoR, QoS and terms of service (including price)

United Kingdom - Poole Harbour																										Options			
		Forecast																											
		Map																											
		Webcams																											
		Wind reports																											
		Accommodation																											
		Schools/Rentals																											
		Shops																											
		Other...																											
GFS		Th	Th	Th	Th	Th	Fr	Fr	Fr	Fr	Fr	Fr	Sa	Sa	Sa	Sa	Sa	Su	Su	Su	Su	Su	Su	Su	Su	Su			
01.07.2010		01.	01.	01.	01.	01.	02.	02.	02.	02.	02.	02.	03.	03.	03.	03.	03.	04.	04.	04.	04.	04.	04.	04.	04.	04.			
06 UTC		07h	10h	13h	16h	19h	22h	04h	07h	10h	13h	16h	19h	22h	04h	07h	10h	13h	16h	19h	22h	04h	07h	10h	13h	16h	19h	22h	
Wind speed (knots)		8	11	11	10	7	9	11	12	9	9	13	11	8	6	5	4	9	13	11	9	11	13	14	15	13	10	8	
Wind direction		↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	
*Temperature (°C)		16	18	19	19	19	18	17	17	17	20	20	19	17	14	14	18	19	19	18	16	15	16	17	16	17	18	17	
Cloud cover (%)		-	100	100	77	87	77	78	75	99	67	64	61	53	87	93	66	40	26	41	82	7							
Cloud cover (%) high / mid / low		-	7	7	10	12	17	68	70	95	68	6					5	6	7	22	42								
Rain (mm/3h)		-						1.3	2.5																				
Windguru rating			★					★		★	★						★		★	★	★	★	★	★	★	★	★		
GFS		Mo	Mo	Mo	Mo	Mo	Mo	Tu	Tu	Tu	Tu	Tu	Tu	We	We	We	We	We	We	Th	Th	Th	Th	Th	Th	Th	Th		
01.07.2010		05.	05.	05.	05.	05.	05.	06.	06.	06.	06.	06.	06.	07.	07.	07.	07.	07.	07.	08.	08.	08.	08.	08.	08.	08.	08.		
06 UTC		04h	07h	10h	13h	16h	19h	22h	04h	07h	10h	13h	16h	19h	22h	04h	07h	10h	13h	16h	19h	22h	04h	07h	10h	13h	16h	19h	
Wind speed (knots)		4	4	7	10	13	12	9	5	3	4	8	9	9	8	4	7	8	11	7	4	5	9	9	9	5	6	10	
Wind direction		→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→		
*Temperature (°C)		14	16	18	20	20	19	16	12	13	17	18	18	17	15	15	17	19	20	18	18	17	15	14	14	15	17	17	
Cloud cover (%)		26	20					57	71	94	86	51	44			8	18	81	79	91	75	97	100	100	83	45	48		
Cloud cover (%) high / mid / low		81	69	17	11		5	6								11	10	20	16	45	47	63	96	95	99	84	91	70	
Rain (mm/3h)																							0.4	0.7	2	1.6	0.3		
Windguru rating						★	★											★											
Lat: 50.7111, Lon: -1.974, Alt: 0 m, Timezone: BST (UTC+1) ☀️ 05:04 - 21:19 🌡️ 15 °C																													
		Detail / Map Tides Archive Link																											

The problem

- Similar problem refers to context of use, security of the process, technical possibility to call a service from certain location etc.

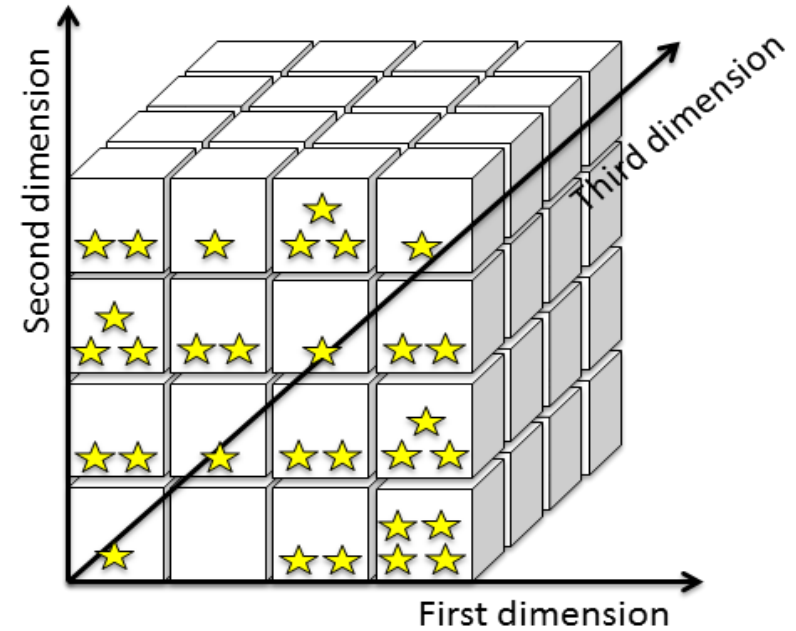


Trustworthiness

- In the relation to IT Systems: the degree of conformance to a given set of requirements and the evidence for this conformance (Suryń, 2011)
- The term is being used mainly by history researchers, where trustworthiness refers to the reliability and authenticity of records (Minnesota State Archives, 2011)
- In linguistic approach: trustworthiness is an attribute of an entity deserving of trust or confidence, being dependable and reliable
- Trustworthiness is therefore
 - conformity with defined requirements
 - evidence corroborating this conformity
- Roughly speaking, trustworthiness may be perceived as the degree of certainty that the service will deliver what the user expects, based on prior experience of all users.

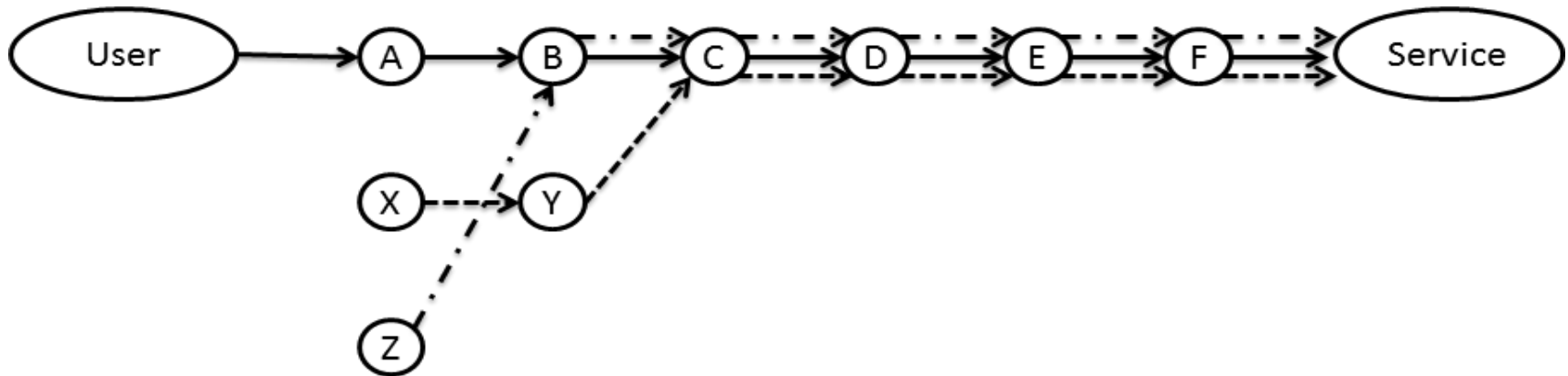
The vision

- Context aware description of Web service
- Feedback from users related to the contexts of use
- Similarity measure of the end-to-end process



Similarity example

- User is to „call” a service through A, B, C, D, E, F
- There are two ranked „calls” which are partially similar



- Desired call
- - -> Ranked call #1
- . - -> Ranked call #2

Summary

- the methodology regarding trustworthiness certification of software (especially COTS) is actually in its experimental phase **Commercial Off The Shelf** trustworthiness of Web Services falls beyond software related framework
- **Trustworthiness of Service Oriented Architecture** requires extension of trustworthiness to the extent of context awareness





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