Migration Paths towards Internet Systems Based on Service-Oriented Architecture and Cloud Computing

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Summary

- Modernization
- Migration to SOA
- Migration to Cloud
- Conclusion

Maintenance and Evolution Trends

- Rapidly evolving external factors
- Well-established internal plans for long-term, progressive modernization
- Narrow line between initial development and maintenance

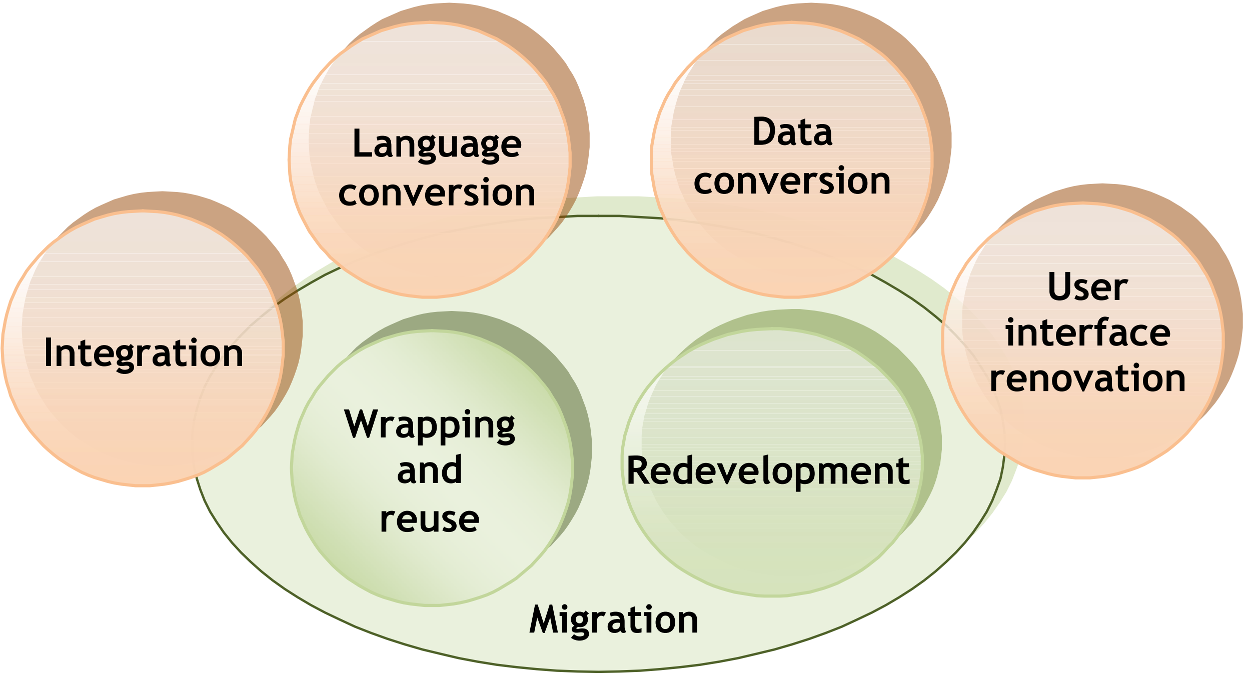
Object-oriented systems maintainability

- Transition to object-orientation
  - middle sized applications (200.000 LOC)
    > 2000 classes
  - Larger systems → > 5000 classes

- Middle-sized application (200 – 500 kilo statements)
  → 2-4 maintenance technicians

Software Modernization

Porting the system to modern languages, libraries, standards, protocols, platforms, hardware



(Bisbal, J.; et al. "Legacy information systems: issues and directions", 1999)

Support for modernization

30% and 35% of the life cycle costs

47% and 60% of the maintenance effort

- **Reengineering**
  - **reverse engineering**

    understanding the structure of the existent code
  - ***forward engineering***

    creation of the new program, better structured from the point of view of extensibility
- **Refactoring**
  - applying various techniques for improving the design of the existent code
- **Restructuring**
  - modifying the code for improving its structure
- **Designing for maintainability**
  - organizing software for being easily corrected and modified

Strategies for redevelopment

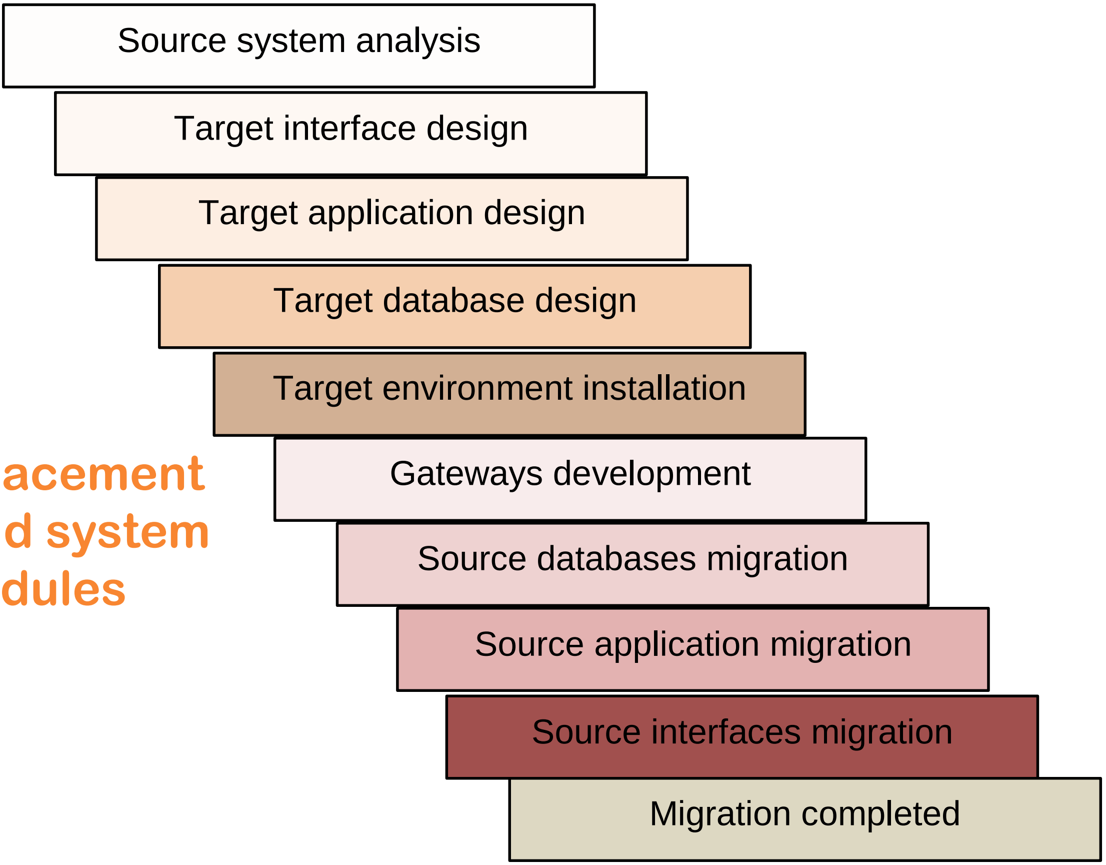
“Cold Turkey”

- direct withdrawal of the legacy application
- replacement with a new one based on services
- may produce discontinuities in the business processes

“Chicken Little”

- gradual approach
- definition of gateways between the legacy elements and the subsystems of the target system.

Steps of the Chicken Little Strategy



Source system analysis

Target interface design

Target application design

Target database design

Target environment installation

Gateways development

Source databases migration

Source application migration

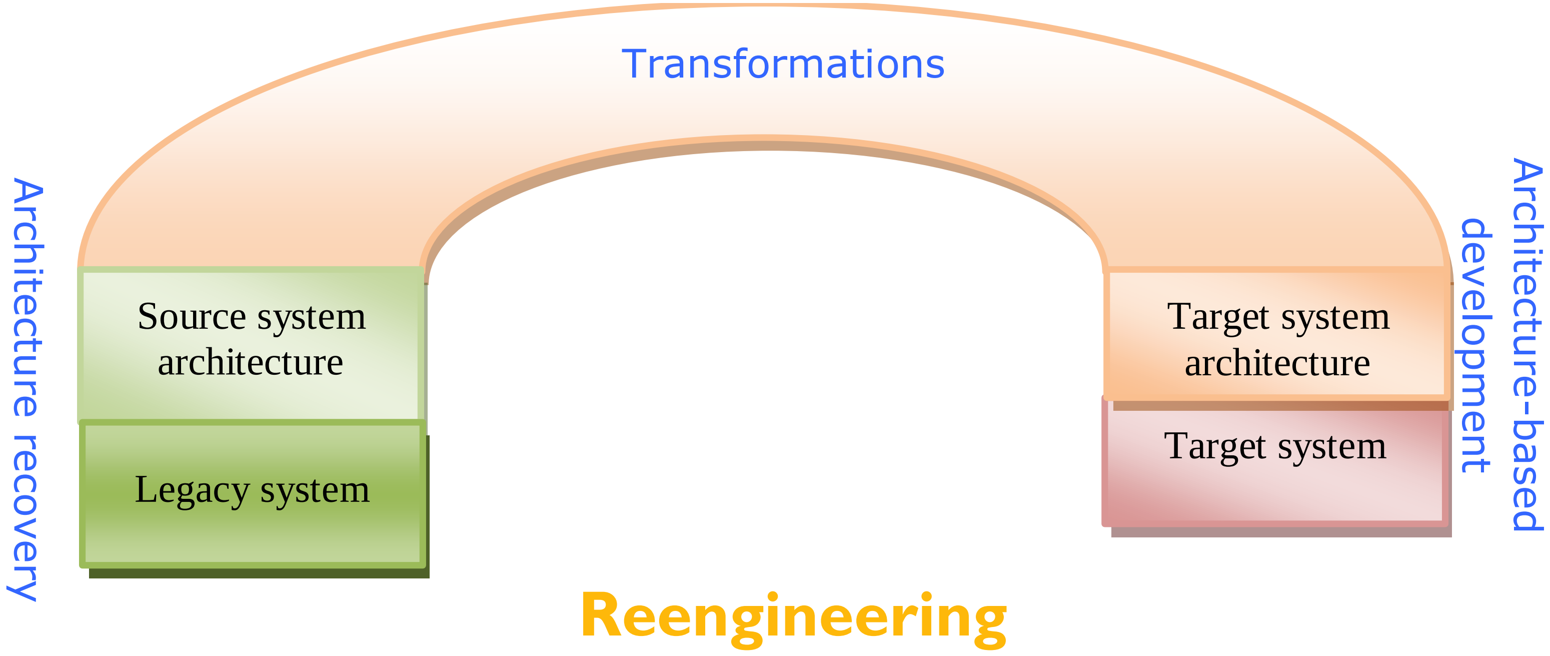
Source interfaces migration

Migration completed

incremental replacement of parts of the old system with new modules

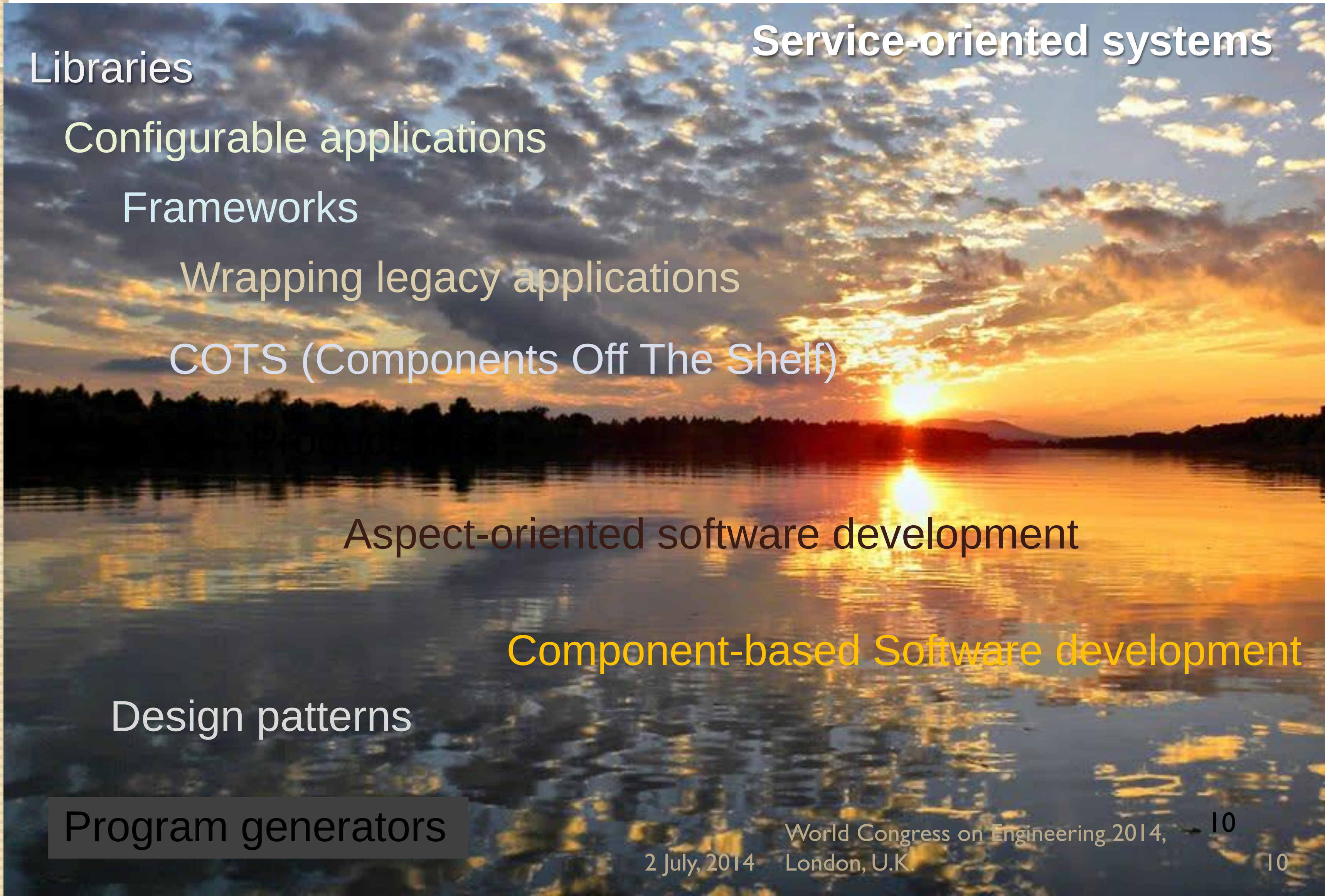
(M. L. Brodie, M. Stonebraker, 1998)

Horseshoe Models


Transformations
Architecture recovery
Source system architecture
Legacy system
Target system architecture
Target system
Architecture-based development
Reengineering

(Kazman, R., Woods, S., & Carrière, J. , 1998)

The landscape of software reuse



Service-oriented systems

Libraries

Configurable applications

Frameworks

Wrapping legacy applications

COTS (Components Off The Shelf)

Product lines

Aspect-oriented software development

Component-based Software development

Design patterns

Program generators

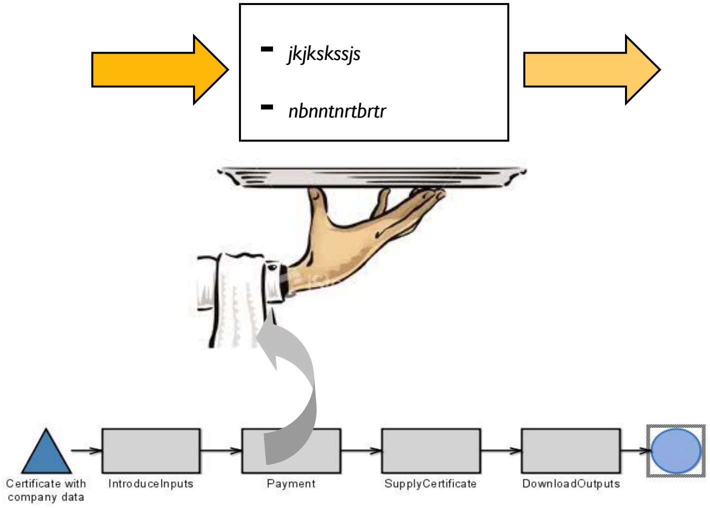
Service era

- Period: years 2000
- Platforms
  - Heterogeneous
  - connectivity through Internet, Intranet
  - service oriented architectures
- Organization structure
  - cooperation of multiple enterprises
- Users
  - Diversification
  - Increased number of users
  - WWW access

- Integration degree:
  - Low coupled services, which interact by interchanging messages
  - Well defined protocols,
  - Service Level Agreement
- Integration process
  - Dynamic definition and management
  - Systems for business process management
- Integration problems
  - Security
  - Versioning
  - Cache
  - Deployment
  - Management

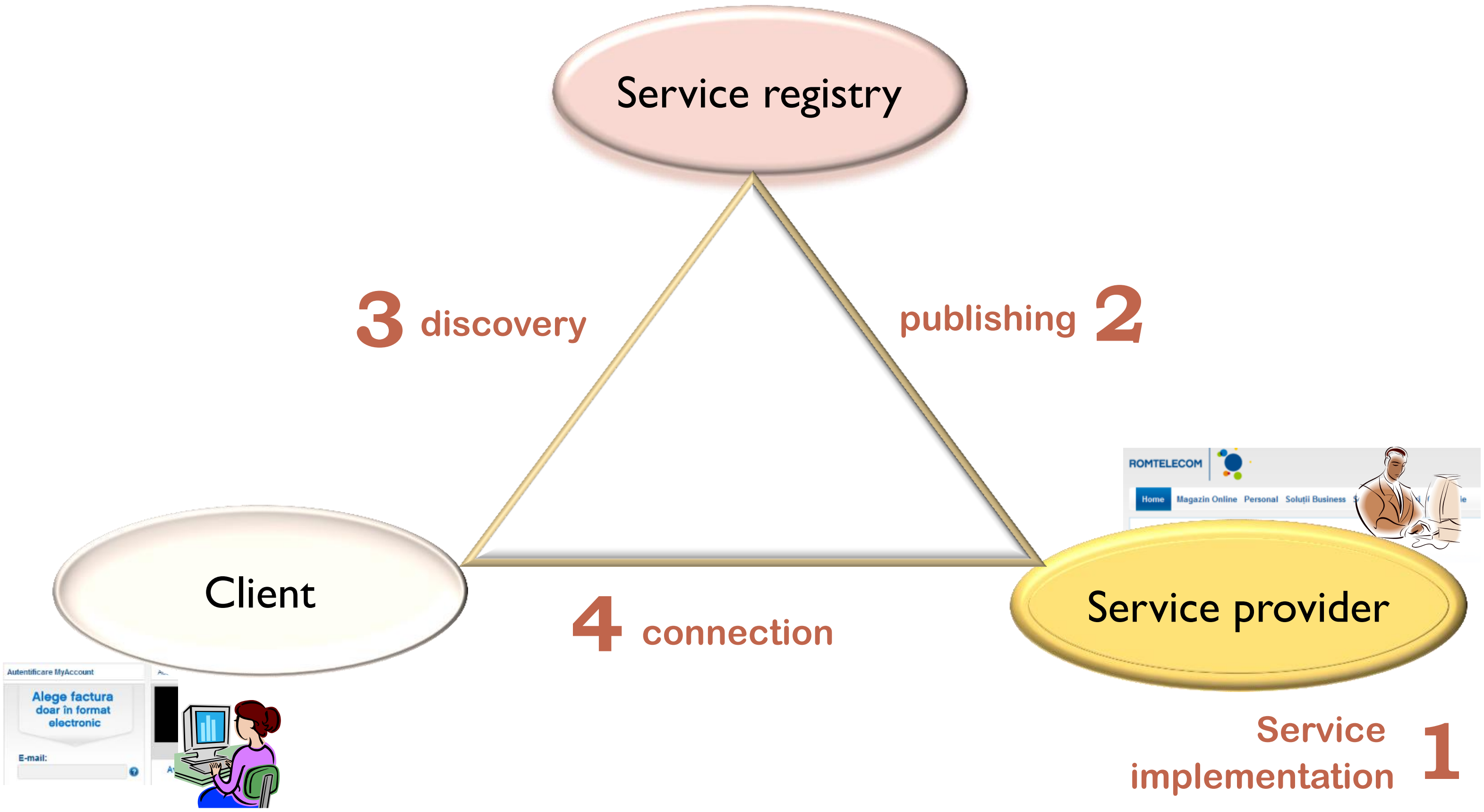
Software Services

- May be executed on different computers, from various service providers
- Supplied locally or externalized
- May be implemented in any programming language
- May embed legacy systems of various organizations



- Independency
- Communication based on XML messages

Service-Oriented Architecture



Cloud Computing

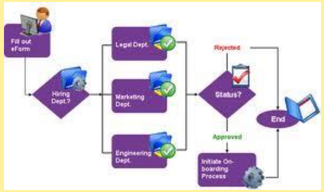
- **Virtualization**
- **Elasticity**
- **Reliability**

- *Software as a Service* (SaaS)
- *Infrastructure as a Service* (IaaS)
- *Platform as a Service* (PaaS)

- a new computational model
- software provided as a service
- users exonerated from software licensing, installation, and maintenance

Migration of legacy systems to services

Access to legacy functionality



New workflows

Code reuse

New roles

Multiple ownership

Distribution

New contracts and policies

Migration to SOA Challenges

- Business-IT alignment
- Componentization
- Infrastructure engineering
- Automated toolsets
- Determining optimal granularity
- Service versioning

Migration to Cloud

- Problems
  - quality
  - security
  - change management
  - configuration management
  - service level agreements
  - monitoring
  - consumption and costs

- **Choosing a Cloud solution**
  - Public
  - Private
  - Hybrid

Survey of Cloud adopters

- cloud applications are better in terms of availability, total cost of opportunity and time to value: 60%
- applications in the public cloud in the next 3 years: 64%
- Integrated cloud applications: 4%
- Challenges: 75%
  - cloud- to-cloud integration
  - mobility access

(B. Narasimhan,.R. Nichols, 2011)

Criteria for migrating to the Cloud

under-utilized assets

few dependencies

traditional backup systems

immediate need to scale

global scale

architectural flexibility

Challenges

Billing

Service Level Agreements

Resource monitoring

Security

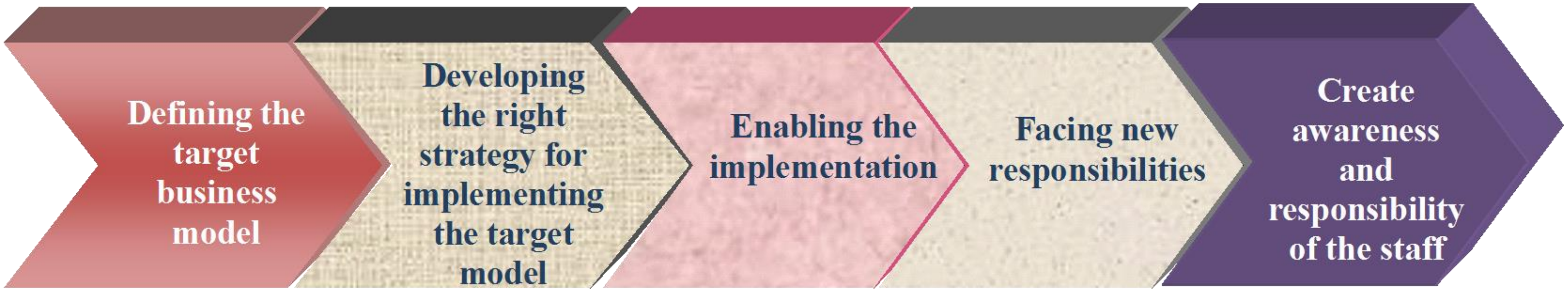
Multitenancy

Quality of Service

Transformation challenges

Organization transformation includes intentional changes, which are performed for a well-defined goal, and have a certain consistency.

Challenges


Defining the target business model
Developing the right strategy for implementing the target model
Enabling the implementation
Facing new responsibilities
Create awareness and responsibility of the staff

(T. Kotnour, Transforming Organizations. Strategies and Methods, 2010)

Migration concerns

Chapter Title	State-of-the-art	Strategy	Methods	Tools	Standards	Practice	Business
Introduction to the Migration from Legacy Applications to Service Provisioning	Y	Y					Y
Research Challenges in the Maintenance and Evolution of Service-Oriented Systems	Y	Y					
Legacy to SOA Evolution: A Systematic Literature Review	Y		Y				
Reengineering and Wrapping Legacy Modules for Reuse as Web Services (Motivation, Method, Tools & Case Studies)		Y	Y	Y		Y	Y
Service Identification and Specification with SoaML			Y		Y		Y
The SOA Frontier. Experiences with 3 Migration Approaches	Y		Y	Y	Y	Y	
Model-Driven Software-Migration - Process Model, Tool Support, and Application	Y		Y	Y		Y	Y
Moving to SaaS: Building a migration strategy from concept to deployment	Y	Y				Y	Y
Migration of data between cloud and non-cloud datastore			Y			Y	
Migrating a legacy web-based document-analysis application to Hadoop and HBase:: An Experience Report	Y		Y	Y		Y	Y
Geographically Distributed Cloud Based Collaborative Application	Y		Y			Y	
Bridging the SOA and REST architectural styles	Y	Y					
Considerations of Adapting Service-offering Components to RESTful Architectures	Y	Y	Y		Y		Y
Model Driven Integration of Non-Homogeneous Software Artifacts in Service Oriented Computing			Y	Y		Y	

PREMIER REFERENCE SOURCE

Migrating Legacy Applications

Migrating Legacy Applications: Challenges in Service Oriented Architecture and Cloud Computing Environments

Anca Daniela Ionita

www.igi-global.com/book/migrating-legacy-applications/68187

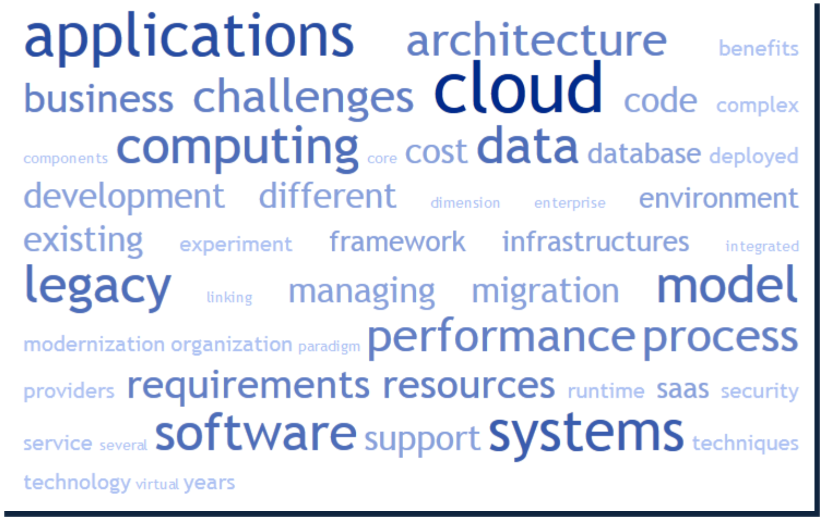
IGI Global

IEEE International Symposium on the Maintenance and Evolution of Service-Oriented and Cloud-Based Systems (MESOCA)

MESOCA
Maintenance and Evolution of
Service-Oriented and Cloud-Based Systems

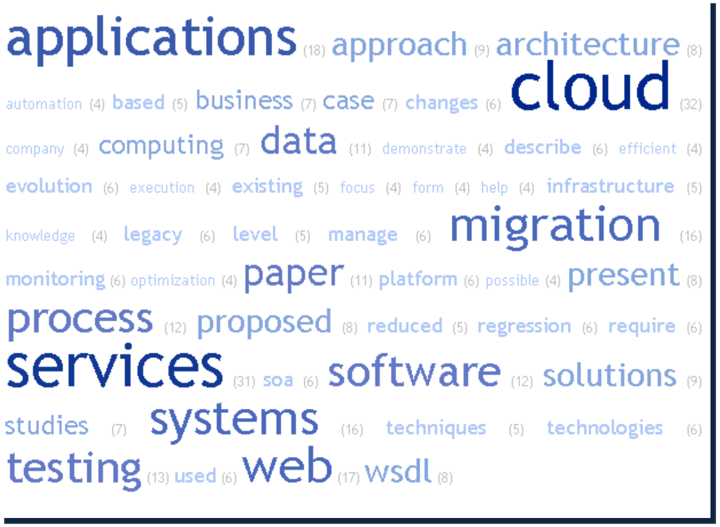
- a co-located event of the IEEE International Conference on Software Maintenance and Evolution (ICSME)
- **MESOCA 2014: September 29, 2014** Victoria, BC, Canada
- http://mesoca.etil.ca/

Tag Clouds of MESOCA 2012 and 2013 Abstracts



applications architecture benefits business challenges cloud code complex components computing core cost data database deployed development different dimension enterprise environment existing experiment framework infrastructures integrated legacy linking managing migration model modernization organization paradigm performance process providers requirements resources runtime saas security service several software support systems techniques technology virtual years

MESOCA 2012



applications (18) approach (9) architecture (8) automation (4) based (5) business (7) case (7) changes (6) cloud (32) company (4) computing (7) data (11) demonstrate (4) describe (6) efficient (4) evolution (6) execution (4) existing (5) focus (4) form (4) help (4) infrastructure (5) knowledge (4) legacy (6) level (5) manage (6) migration (16) monitoring (6) optimization (4) paper (11) platform (6) possible (4) present (8) process (12) proposed (8) reduced (5) regression (6) require (6) services (31) soa (6) software (12) solutions (9) studies (7) systems (16) techniques (5) technologies (6) testing (13) used (6) web (17) wsdl (8)

MESOCA 2013

Conclusion

Migration to services is timely.

- Suitable processes needed
- Integrated tool suites
- More automation
- Standards for interoperability
- Socio-legal challenges