

# Report on a Mapping Study Examining Web Service Composition

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**Abstract:** The purpose of this study is to explore the resources (papers, technical reports) that tackle web service composition approaches (techniques) from different aspects, to aid with evaluating and comparison, and also to find guidelines on the most effective approaches to composition that we might follow. The focus of this research related to web service composition, with the aim of locating, assessing and synthesising outcomes to benefit both researchers and practitioners. We chose four electronic archival databases and reviewed the papers published in the period between 2000 and 2007.

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## 1 Introduction

The emergence of Web services as a platform independent basis for distributed systems is encouraging a number of Companies to run their business services over the internet. Therefore, many techniques and tools are being developed to build those systems or to connect business to business/business to customer applications together. Moreover, researchers are explaining ways to build new services from existing services by composing services from a range of resources. We can classify the way that services are linked together as *static composition* (binding at construction time) and *automatic composition* (binding at run time).

The challenge this creates is how to find the best way to enable the dynamic composition of services drawn from distributed autonomous agencies and selected on the fly, in order to meet specific run-time requirements. To perform a systematic literature review that to collects evidence related to service composition we wrote a mapping study protocol for services composition.

## 2 Organisation of the Mapping Study

In conducting our mapping study we addressed a number of activities associated with planning a review such as identification of the need for a review, research strategy, classification of papers, study selection criteria, study quality assessment and data extraction strategy and process (Kitchenham et al, 2007)( Brereton et al, 2006).

### 2.1 Identification of the need for a review

To identify our research and identify papers of interest, we need to use **keywords** such as *web service*, *web service composition*, *automatic service composition*, as keys to collecting the papers. The **research questions** aimed at providing the initial indicators to possible approaches and solutions proposed, **population** is the published scientific literature reporting service composition, **intervention** is the experiments and studies involving service composition practices techniques and processes, **outcomes of relevance** is the Quantity and Type of Evidence relating to various service composition techniques and processes.

## 2.2 Search Strategy

Using keywords to search for primary studies and identify the population, intervention and outcome. The strategy was to identify a set of receivable web services electronic database as principal search sources of primary studies, and to determine the relevance of papers on the basis of the presence of particular key terms in the title, keywords list or abstract of a paper.

## 2.3 Classification of Papers

Sometimes the number of retrieved papers was large and thus classifying them using a number of keys assists (as wondering about identification, classification and methods) with processing classification: *this type of ..., several kinds of ..., in this category..., can be divided into..., classified according to..., is categorized by...*

## 2.4 Study Selection Criteria

A systematic review of the literature should cover all potentially relevant resources; therefore we chose to include conference papers, technical reports and workshops. To avoid irrelevant papers we excluded literature that was only available as abstracts or in a slideshow format and we also excluded the studies that do not describe or make use of services composition and those that do not have an empirical element.

## 2.5 Study Quality Assessment

There was no study quality assessment to ensure maximum coverage at this early stage of the mapping study. We decided to include in the review all those papers from selected sources that we were considered relevant.

## 2.6 Data Extraction Strategy

The mapping study exercise was designed to allow for the categorisation of published literature; as such the data extraction strategy was restricted to simply obscuring the information required for classification.

# 3 Results of Mapping Study

In implementing the protocol a number of scientific databases were searched for papers addressing service composition, and the empirical papers were selected from them. At the same time some criteria to use in classifying these papers with regard to common mechanisms in service composition were identified.

The Empirical Papers were collected from four electronic archival databases (IEEE Xplore, ACM, ScienceDirect and CiteSeer). The total number of empirical papers found in these was as follows:

Electronic Database	No of Empirical Papers	*Total Papers per Database
IEEE Xplore	52	100
ACM	59	200
ScienceDirect	30	86
CiteSeer	9	218
Total	150	604

\* Total Papers per Database: these number obtained by using our keywords.

## 4 Classifying the Papers

From the papers that we found through our search we extracted the empirical papers, with the process of selection also identifying the research method that the papers used (see appendix A).

After identifying of the empirical papers, these were classified depending on their models (how these models address different application areas and requirements), into three categories as follows:

- **Static approach:** this category contained all papers that describe or provide approaches that might web service providers utilize to offer their services to others. Also the approaches that need intervention from the user to develop the service. Most standards subscribing fall under this category.
- **Automatic approach:** this approach looks at the use of semantic descriptions of web services. The process of selecting and controlling the final set of services takes place without intervention of the users.
- **Semi-Automatic Approach:** in this approach the web service composer will intervene in some stages of composition. (Shuiguang *et al*, 2004)(Keita & Tatsuya, 2004) (Hall & Humberto 2003)(Aggarwal *et al*, 2004)(Thakker *et al*, 2006).

## 5 Ongoing Work

The complete classification of the selected papers with regard to the different approaches is detailed in the following table:

		Static	Automatic	Semi-automatic
Electronic database	IEEE xplorer	34	16	2
	ACM	33	26	-
	ScienceDirect	18	11	1
	CiteSeer	2	6	1
Total		87	59	4

## 6 Future Work

In the next step, we will perform a further analysis of these papers, and we will examine the most interesting approaches that deal with automatic service composition, involving both the service description and the service specification from both requester and provider views.

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## \*Appendix A

RESEARCH METHOD	DESCRIPTION
<b>AR – Action Research</b>	Researcher participates in the action studied. Differs from participant observation as researcher is aware that their presence will affect the situation they are researching [1].
<b>CA – Conceptual Analysis</b>	Basic assumptions behind constructs are first analysed; theories, models and frameworks used in previous empirical studies are identified and logical reasoning is thereafter applied [5].
<b>CAM – Conceptual Analysis/mathematical</b>	CA using mathematical techniques.
<b>CI – Concept Implementation/proof of concept</b>	Self-explanatory – ‘We built it and it worked’.
<b>CS – Case Study</b>	A method, tool or procedure under investigation is tried out on real project using the (otherwise) standard methods/tools/procedures of the organisation [2].
<b>DA – Data Analysis</b>	Analysis of data generated or published elsewhere.
<b>ET – Ethnography</b>	Research participates in the action studied. Differs from AR in that researcher has no intent of interference in phenomenon, does not relate findings to generalisable theory and does not interpret from researcher’s point of view [1].
<b>FE – Field Experiment</b>	Extensions of laboratory experiments into the ‘real world’ of organisations/society. Independent variables are controlled [1].
<b>FS – Field Study</b>	Examine data collected from several projects (or subjects) simultaneously. Less intrusive than case study. Usually less detailed than case study because aims not to perturb subject under study [3].
<b>ID – instrument Development</b>	Development of MIS (or other) instrument (e.g. user satisfaction questionnaire) [8].
<b>LH – Laboratory Experiment – Human Subjects</b>	Identification of precise relationships between variables in a designed controlled environment (i.e. a laboratory) using human subjects and quantitative techniques [1].
<b>LR – Literature Review/analysis</b>	Examine/analyse previous publication [1].
<b>LS – Laboratory Experiment – Software</b>	A laboratory experiment to compare the performance of newly proposed system with other (existing) systems [6].
<b>MP – Mathematical Proof</b>	Self-explanatory
<b>PA – Protocol Analysis</b>	Used to reduce the large amount of data generated by use of ‘think aloud’. Requires the production of a protocol (a categorisation of the possible relevant utterances) and the application of that protocol to gathered data [4].
<b>SI – Simulation</b>	Execution of a system with artificial data [1], using a model of the real world [3].
<b>ES – Descriptive/Exploratory survey</b>	An exploratory field study in which there is no test of relationships between variables [7].

\* O.P Brereton, N.E. Gold, D. Budgen, K.H. Bennett & N.D. Mehandjiev, (2006), Systematic literature review: a pilot study of service-based systems, *Technical Report, TR/06 – 01, Keele University*

## Source of Definitions

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