Working Group for
the Standardization of
Space Based Computing

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WORKING GROUP INITIATOR

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[SPACEBASEDCOMPUTING.ORG MANIFEST]

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PREAMBLE

Space based computing (SBC) is an innovative and powerful concept for the coordination of autonomous processes. It is based on the notion of a common, abstract space connecting distributed processing entities over a network. Instead of explicitly exchanging messages between individual processes or performing remote procedure calls, processes communicate and coordinate themselves by simply reading and writing distributed data structures in a shared space. Synchronization is carried out through the access of data in space which might block if the denoted data are not yet here. Processes interact in a data driven way supporting event-driven architecture concepts. This leads to a decoupling of all participants concerning time, space and reference. The space inherently offers the advantages of reliable communication, transactions, asynchrony, near-time event notification, scalability and availability.

A space offers a high level abstraction for developers hiding complexity that otherwise would be reflected in the application code thus reducing development time and costs in distributed applications. It offers a lean application programming interface but nevertheless exhibits a high expressiveness.

In continuation to the concept of a message queue and topic-based publish-subscribe, which is the state-of-the-art communication technology in today's enterprise application integration architectures, a space allows for the easy realization of more sophisticated integration patterns like auction, market place, and dynamic and adaptive load balancing characterized by more than two actors being involved able to make dynamic and autonomous decisions based on up-to-date data they find in the space.

The SBC paradigm was originally applied for parallel computing and influenced by the *Linda* model. Many facets of spaces have been proposed and we expect that promising new technologies such as Semantic Web, Service Oriented Architectures (SOAs), mobile computing, GRID computing, robotics, and agent technologies, require new approaches towards distributed systems that they particularly can profit

from SBC. Nonetheless, the paradigm is currently not well-known to a broad audience and SBC approaches have not yet gained industrial attention by major software vendors.

This initiative is aimed at producing the required visibility in industrial and scientific communities, stimulating widespread adoption of the space based computing paradigm. The main activities will comprise:

- Raising awareness and visibility of the paradigm in the industry,
- Showcasing solutions based on SBC,
- Supporting convergence of space based platforms,
- Influencing standardisation by transfer of proven best practices, and
- Building a community for researchers, developers and users.

Major customers that can profit from SBC are for example: banking and insurance companies, telecommunication, vendors of distributed games, collaborative and mobile applications and system integration houses. The advantages comprise dependability, savings in development costs, leaner software architectures, and new application possibilities.

MISSION STATEMENT

SpaceBasedComputing.org's mission is to expedite acquiring and disseminating knowledge, promoting and propagating the paradigm of space based computing.

SpaceBasedComputing.org aims to canonize multiple facets of existing space based computing solutions and to promote a common reference architecture motivating developers to leverage the potential of this technology. The common reference architecture will relate space based computing to established standards in distributed computing. In particular, the space based computing paradigm will impact state-of-the-art technologies and their standardization like Coordination, Web Services, Semantic Web, and Business Process Languages.

The SpaceBasedComputing.org initiative will continuously collect and publish documents, surveys and standardization papers about space based computing, acting as a central facility for all activities around space based computing. It will foster joint publications of the contributing members, organize conferences, workshops and other events and promote the funding of research efforts.

GOALS AND STRATEGIES

The SpaceBasedComputing.org initiative will

- Canonize existing standards and implementations in the fields of space based computing, with the goal of improving interoperability between different implementations.
- Promote the integration of the space based computing paradigm with other standards and target systems.
- Maximize visibility of the paradigm and increase adoption of space based computing in both research and industrial environments.
- Define ways of how space based computing can be exploited by industry and prove its power in commercial applications and projects.
- Adapt design and development methodologies to the space based computing paradigm.

The SpaceBasedComputing.org initiative achieves these goals by

- Defining and establishing an open, community-driven process for the creation of space based computing architectures.
- Providing a platform for communication and cooperation with international standardization organizations such as W3C or OASIS.
- Organizing conferences, workshops and other events.
- Managing joint marketing, lobbying, funding, and promotion efforts for itself and its sub-organization.
- Creating a visible and strong community supporting the ideas of space based computing.
- Disseminating related literature, and publishing white papers and road maps.
- Issuing and organizing calls for proposals.

NON-GOALS

SpaceBasedComputing.org is **not** intended to promote competitive architectures to existing standards in the fields of e.g. Business Process Languages, Semantic Web, GRID computing, and Service Oriented Architectures.

SpaceBasedComputing.org is **not** intended to define space based computing by means of an API specification but rather to promote space based computing as a high-level communication paradigm.

SpaceBasedComputing.org does **not** define standards by itself but rather sees its responsibility in collecting standards from the relevant bodies in this area and in coordinating the communication and exchange of know-how between them. It also recommends extensions of existing standards in order to exploit space based computing.

SpaceBasedComputing.org does **not** aim to compete with existing standardization organizations. It views its role in complementing and enriching existing standards by cooperating with the corresponding organizations.

STRUCTURE

ORGANIZATIONAL STRUCTURE (1ST STEP)

- Board of chairs
    - Oversees all activities of the organization
    - Represents the organization in all matters
- Technical architecture board
    - Definition of projects
    - Issuing of Requests for Proposals
    - Establishing of experts groups

MEMBERSHIP

- Types
    - Academic
    - Other organizations
    - Industrial partners
    - Sponsors
    - Individuals

EXPERT GROUPS FOR ARCHITECTURE

The SBC Reference Architecture from which the first expert teams can be derived is a layered architecture consisting of a communication & coordination layer, a semantic adaptation layer and a (business) process layer. In addition, an expert group for the definition of typical SBC business cases will be installed.

Layered architecture:

The SBC reference architecture aims at creating an open platform for internet wide collaboration and cooperation. Today, enterprises' IT systems are affected by major forces that change the way IT systems are architected:

- Enterprises must react promptly and effectively to fast changing economic environments. This requires agile IT infrastructures

based on new or re-engineered services that can be assembled quickly into new systems adapted to changing business requirements. This architectural style has been subsumed under the term "Service oriented architectures" (SOA).

- A new, powerful economic paradigm is emerging, where people all over the globe collaborate to create new products and services, leveraging on the virtualization of the knowledge worker's workplace. This trend is mostly confined today to human interaction and collaboration like "wikis", "blogs", "social networking", etc. but it is evident that it will ultimately include any kind of information systems and devices.

The SBC reference architecture addresses these requirements on IT infrastructures by providing the foundation for seamless collaboration of intra-enterprise systems and extra-enterprise systems and by facilitating the collaboration between various type of information system and devices.

The SBC reference architecture provide an open foundation for the communication, coordination and interaction of multiple, autonomous systems.

The Base Layer provides communication and coordination capabilities on top of standardized internet protocols. The abstraction offered by the base layer is defined by a virtual and secured space. The space is the "meeting place" where communication partners exchange information negotiating and coordinating their contributions to a common goal.

The Semantic Adaptation Layer normalizes the semantics of exchanged information into single, common, semantic representations. It adapts common facilities like process definitions, security policies and assertions and management policies providing a common infrastructure for all communicating partners.

The Process Layer defines the behavior of each communication partner and its contribution to the common goal. The process layer models the overall behavior and describes each contribution individually.

The approach taken by the SBC reference architecture is evolutionary: the architecture can be thought as a further step of today's Enterprise Service Bus (ESB) architecture that facilitates the implementation of Service Oriented Architectures.

Space based communication can be seen to generalize the message based communication of an ESB by the coordination capabilities of the space.

First Working Groups:

According to the layered architecture, in a first step, the following working groups will be gradually be launched to coordinate input for the SBC reference architecture. Start is the WG-1. Detailed roadmaps will be worked out jointly with all working group chairs and members, as soon as the working groups have been constituted.

WG-1: SBC BUSINESS CASES (Chairs: Javier Martínez Elicegui, David de Francisco, Telefonica Spain)

- Demarcation of SBC versus established Message Oriented Middleware (MOM)
- Which existing and emerging markets will mainly benefit from SBC and why?
- Which new application scenarios become possible that could not be solved otherwise in a satisfactory way?
- Identification of business scenarios and use cases where SBC is a "must have"
- Business advantages of using SBC

WG-2: PROCESS LAYER (Chair: Frank Leymann, University Stuttgart)

- Enhancing and influencing mainstream Web Service standards by the SBC paradigm: WSDL, SOAP, BPEL etc.
- Relationship with established standardization organizations in these areas
- Definition of bindings to an SBC grounding (XVSM)

- Modeling of space interactions and patterns that go beyond MEPs (message exchange patterns) for EAI (enterprise application integration)

WG-3: SEMANTIC ADAPTATION LAYER
(Chair: Emanuele Della Valle, Cefriel Politecnico di Milano)

- Employing semantics to describe the space (e.g. ontologies for a meta-model, security etc.)
- Describe impacts and importance of SBC on the possibilities of semantic web
- Definition of a higher-level infrastructure for the intelligent and reliably distribution and publishing of semantic and RDF based information in the web based on the APIs elaborated in the TripCom EU project[1]

WG-4: COMMUNICATION & COORDINATION LAYER (Chair: eva Kühn, TU Vienna)

- Definition of an open, language independent, extensible, web-scale capable communication and coordination layer for SBC target systems and architectures based on and extending the classic Linda coordination model by more structure and openness
- Transforming the requirements from use case, process and semantics layers into a standardized space communication and coordination layer being based on virtual or distributed shared memory and standardization efforts[2] in the area
- Definition of communication protocols for the Internet

[1] www.tripcom.org

[2] www.xvsm.org

DOCUMENT HISTORY

Issue Date	Version	Author	Change
2006-08-26	0.1	eva Kühn	Initial draft
2006-09-20	0.2	eva Kühn	Document structure changed after telco with Dieter Fensel, Frank Leymann and Robert Tolksdorf
2006-09-28	0.3	eva Kühn, Geri Joskowicz, Martin Murth, Johannes Riemer, Fabian Schmied	Improvement of mission statement, and goals
2006-10-08	0.4	eva Kühn	Minor changes
2006-10-18	0.5	eva Kühn	Changes according to meeting in Stuttgart with Dieter Fensel, Frank Leymann and Robert Tolksdorf
2006-11-11	0.7	eva Kühn	first sketch for SBC reference architecture
2007-01-26	0.8	eva Kühn	details of the layered architecture; definition of 4 working groups; rework of structure of the .org;
2007-01-31	1.0.0	eva Kühn	improved motivation & preamble
2007-02-01	1.0.1	Robert Tolksdorf	Added comments and made changes
2007-05-22	1.05	eva Kühn	update of introduction and WGs
2007-11-01	2.0	eva Kühn	update structure