# A Novel Network-centric Infrastructure for Social Networking Services using a Messaging Network

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## Abstract

*The present paper introduces an intelligent infrastructure for social networking services using a messaging network. The proposed messaging network can provide content/topic-based routing and filtering. The proposed scheme provides a network-centric approach to ensure flexible information aggregation and message mediation for social networking services.*

## 1 Introduction

Social networking services are widely used and provide an important infrastructure for a knowledge-based society, and various other types of societies. A social networking service should provide elastic, flexible, and sustainable messaging to users with simple operation. A social networking service should also handle a wide variety of data, contents, and services. A system for a social networking service must change with internal and external changes in the requirements of the social networking service and its system. Service-oriented architecture (SOA) is an architecture that enables users to change their systems according to internal and external demands [1, 2]. Service-oriented architecture can help construct a social networking service as well as ensure its availability and sustainability.

There have been a number of studies on information aggregation for social networking services [3]. Most existing approaches are either server-based (publisher-centric) or client/device/user-based (subscriber-centric). However, for heterogeneous service and content aggregation, the publisher-centric approach requires large, complex tasks of the publisher (servers), and the subscriber-centric approach requires the user of the system to spend time and money to find and aggregate necessary information.

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The present paper proposes a network-centric scheme in order to help construct, maintain, and manage an elastic, flexible, and secure social networking service. In particular, the proposed approach provides a common proactive scheme aimed at realizing an elastic, flexible, and secure social networking service using a network infrastructure that is based on an actual framework of content/topic-based networking, which is referred to as a messaging network.

## 2 Proposed Scheme for Social Networking Service

The proposed scheme is based on a messaging network and is able to provide content-based message filtering, content-based message routing, topic-based message filtering, topic-based message routing, message mediation, message logging, and so on [2].

The use of a network-centric approach can provide solutions to overcome the abovementioned current inherent weaknesses of subscriber-centric and publisher-centric networks. In a network-centric approach, subscribers convey their subscriptions to the network, which is responsible for the management of message delivery. In a network-centric approach, publishers merely publish new messages (contents and services) to the network whenever they become available. A network-centric scheme can also provide the following: i) shared subscription management infrastructure, ii) optimal bandwidth management, iii) shortest path content multicasting, and iv) scalability on demand to accommodate large networks.

Therefore, the present paper uses a network-centric approach, which is an infrastructure enabling a common proactive framework for social networking services.

The proposed scheme can be constructed as a structured overlay network over an existing Internet using messaging appliances [1]. The proposed messaging network can achieve service integration through extensive use of asynchronous messages and various types of message routing

and message mediation, as well as other content-processing functions. Using a messaging network, a publisher (a data/service source) is not required to maintain information about the subscribers (data consumers) for the message delivery from the publisher to the subscribers. A publisher merely sends new content to a publish-subscribe channel in the content-aware network configured on a messaging network whenever the new content becomes available.

The proposed messaging network can interpret the contents of messages in order to deliver, filter, distribute, and process the messages. A content-aware messaging network can connect, combine, aggregate, and integrate services while maintaining each of the services to be as independent as possible.

The proposed scheme also provides topic-based filtering and routing. Topic-based systems use named logical channels or "topics." In a system with a topic-based scheme, messages published as "topics" specified by the message publishers can be included. Prospective organizers should submit proposals that contain a statement describer or message router. Subscribers make a list of topics, and related messages should be delivered to the subscribers in advance. The subscribers then use a topic-based scheme to receive all of the messages published on the topics to which they subscribe, and all subscribers to a topic will receive the same messages. The publisher is responsible for specifying the topics related to the messages to be published.

The proposed scheme is based on asynchronous messaging. The proposed scheme can be realized using existing messaging appliances with low latency [2].

The proposed scheme can provide the following solutions for the requirements discussed above:

- Pushing Requested Messages: The publisher of a message specifies the topics related to the message. The published (dispatched) message will be delivered to a topic-based router. The topic-based router selected the proper subscribers from the list of subscribers to the topic. Consequently, the messages are delivered to the users who want to read the messages related to the topic. 0 The topic list will be registered and used by the messaging routers in the network. The message will be sent to a content-aware router so that the message will be converted into an appropriate format for the subscriber. The messages, which are sent from the topic-based router, will be stored in a data store for the topic.

- Format Mediation: Messages that are to be delivered to a user are routed to a format conversion node by a content-aware router, which can specify the appropriate format based on the information of the destination for the message delivery and the type of content to be delivered.

- Archived Messages: The messages, which are stored in the topic, can easily be retrieved by a user, who need only specify the topic and additional keywords, and the messages will be collected and sent to the user.

- Message Mashup: When a user wants to specify a particular content, a particular service, or a particular topic, the request will be sent to the messaging routers. The proposed system has a database of the relations between the topics, contents, and services. Consequently, messages related to the specified content/service will be delivered to the user. The proposed scheme can convert the messages in order to create an message aggregation (mashup of the messages). The database of the relationship among the topics, contents, and services is constructed and managed by a graph database.

- Service Integration: The proposed scheme can realize a loosely coupled integration of the service by applying message mediation to the mediation of the application program interfaces of the services that are to be integrated.

- Policy Mediation: The proposed scheme can connect networks having different policies through message mediation and content-aware filtering. Message mediation is used to convert messages to meet the format requirements of the delivery-destination network. Content-aware filtering is used to remove part of the message that may not be accepted by the destination.

The proposed scheme also uses various types of data stores and graph databases. A graph database uses graphs with nodes, edges, and properties to represent, store, and handle the stored data [4]. The propose scheme uses a graph database for the representation of the relationships of the contents, services, and topics. A graph database can be used for the linkage of the messaging routers and is used to represent the relationship of the policies of the social networks.

The present paper also proposes a network-centric scheme for the functions for social networking service systems, such as discovery, policy management, and security. Discovery is necessary for the social networking services in order to find a proper set of contents and services related to the demand of the user. Policy management is needed in order to apply the rules to the services to be used in a social networking service system.

Discovery can be defined as the subscription, repository, and registry functions provided by a messaging network. A message (service/content) registry is a resource that provides controlled access to provided services and contents, whereas a message repository provides information about the available messages. The message registry allows service/content users to efficiently discover and communicate with each other using the services, whereas the message

repository consists of a database containing the software and meta-data that constitute a message registry. The proposed scheme locates a service that conforms to the requirements listed in the messaging network subscription from the registry stored in the messaging network. In order to ensure flexibility and elasticity in social networking service systems, social networks should collaborate with each other. However, there are differences in the policies of the collaborating networks. The proposed scheme can provide policy mediation using message mediation gateways [5]. This function can be applied to overlaing slices [6] having their own policies in a single overlay network.

We have constructed a sample implementation of the proposed scheme using Solace 3230 Message Appliances (Solace Systems Inc. `http://www.solacesystems.com`), Apigee Application Program Interface (API) Gateway (Apigee Corp. `http://apigee.com`), and several network eqiuipments, servers, and clients. Figure 1 (a) and (b) demonstrate the actual control panel windows of the topic-based router and API gateway, which are used in the sample imprementation system of the proposed scheme. Figure 1 (a) shows the status of the message queues. Figure 1 (b) indicates the control panel of the API gateway of the system. Figure 1 (c) indicates a snap shot of the read out of the system.

## 3 Conclusion

A novel network-centric scheme for flexible, elastic, and secure social networking services is proposed. The proposed scheme can provide a common proactive infrastructure for various message (content/service) providers and various message users.

The proposed scheme uses a messaging network that contains the actual architecture of a content-based network, a topic-based network, and so on. The various functions of the messaging network provide a messaging network in an open common networking infrastructure. The proposed messaging network can be considered to be an intelligent infrastructure. Requirements for an elastic and flexible social networking service system were discussed, and several solutions for satisfying these requirements were presented.

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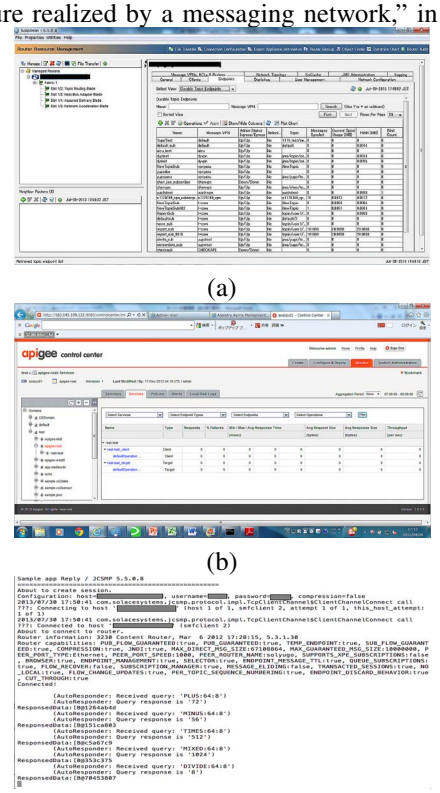


(a)

(b)

(c)

**Figure 1. The control pannels of the Messaging Appliance (a) and the API gateway (b) and a snap shot of the read out of the system.**