network, including the Internet or a Local Area Network. According to one embodiment of the invention, the server **20** is a collaboration server that enables both real-time conferencing and content management. Thus, client applications can connect to the server to share data and collaborate in real-time. The server allows fine grained sharing of any type of content using generic shared objects (GSO). Each GSO holds one or more pieces of persistent information and defines a list of people who are allowed to access the information. Each GSO also represents a persistent conferencing session., i.e., if clients modify GSOs, modifications are broadcast to all the other clients on the list of the shared object if they are connected. The server also manages relationships between shared objects; i.e., shared objects could be contained in other shared objects or reference other shared objects. As an example, the server might support hierarchical storage of shared objects similar to a file system. The advantages of this system are high flexibility in developing new collaborative applications without the need of defining semantics on the server side, protocol efficiencies through combining conferencing and content management in one system, support for fine-grained sharing of any content, support for developing applications that provide a seamless user experience with blended asynchronous and synchronous collaboration.

[**0024**] Several components that may be included in a collaboration server of the present invention are shown in **FIG. 1**. A second embodiment of the present invention, where the server functionality is distributed to the individual clients to permit peer-to-peer object sharing will be described later herein with regard to **FIG. 6**. These components are representative of the functionality of the server only, and thus it is not a requirement that the exact components as illustrated be included in the server. The components are illustrated as functional blocks, each of which may be implemented in hardware, software, or some combination thereof.

[**0025**] Server **20** is shown to include access control logic **26** coupled to object database **28**. The access control logic **26** controls access to and modification of objects within the object database **28**. Coupled to the access control logic **26** is navigation logic. The navigation logic **26** includes a relation database including data defining relationships between the various GSOs stored in object database **28**. Also coupled to access control logic is broadcast interface **22**. The broadcast interface **22** controls the broadcast of modifications to GSOs to identified interested clients, to facilitate synchronous conferencing between clients sharing objects.

[**0026**] Each client that is coupled to the server of the present invention includes an application programming interface (API) and an optional database **18** to cache local copies of GSOs managed by the server. Although an independent database storage component is shown, it is understood that the database of GSOs managed by the server could be stored in any storage mechanism of a computer system, including a local cache, a file system, memory, attached disk drive, etc. The application programming interface uses a defined protocol to communicate with the server. In one embodiment, the communication protocol that is used between the client and the server may be text-based (e.g. extensible Markup Language (XML)) or in any binary format. As will be described in more detail later herein, the protocol is based on three basic primitives: Request, Response and Notification. A client asks for some service by forwarding a Request package to the server. The server responds with a Response package to inform the Requesting clients about the result of its request. Depending on the type of request, the server may also send Notification packages to other connected clients. Accordingly, services provided by the server merge real-time conferencing with content management, i.e., both real-time sharing of information is persistent and asynchronous shared content can be modified in real-time.

[**0027**] At the server **20**, the object database **28** is used to store data structures for objects used by the server. The database may be, for example, a file system, databases, or any other storage mechanism to persist shared information. The objects stored in the database include both the GSOs, as well as other related objects that may be used by the server for the support of the invention, including but not limited to objects that represent a person, group objects to represent a group of members, member status objects to represent information about members with regard to a particular GSO and subscription objects to describe member's interest in real-time notification from a particular GSO.

[**0028**] Referring now to **FIG. 2**, a more detailed diagram illustrating one embodiment of a GSO data structure is provided. Using generic shared objects as a means of providing persistent real-time collaboration is an important aspect of the present invention. As mentioned above, each GSO holds one or more pieces of persistent information and includes a list of people who are allowed to access the information (access control list—ACL). At the same time, each GSO also represents a persistent (conferencing) session, i.e. if clients create, modify, or delete GSOs, notifications are broadcast in real-time to all the other members of the GSO (if they are connected at that time). Hence, when clients disconnect and then reconnect to the server at a later time, GSOs are still available and communication can become synchronous again if other members are present. GSOs may also be used for non-persistent communication between any members of the shared object much like a message hub.

[**0029**] A GSO data structure may take any form, and an exemplary GSO data structure is shown in **FIG. 2**. The GSO of **FIG. 2** includes a set of general properties **32** and a set of variable properties **34** for content. General properties identify certain attributes of the object, without addressing the particular content of the object. General properties are generally populated by the collaboration server when the object is created, and modified by the server in response to specific requests from the clients. For example, general properties of GSOs may include unique id, name, author, creation time, modifier, modification time, reader, last access time, access control list with member and group objects, member status and subscription information pertinent to the GSO. The present invention is not limited to the inclusion of any item in the general properties other than the access control list.

[**0030**] Variable properties of a GSO describe the actual content of the data structure. A GSO does not provide any means for semantically describing the content. Content is associated with a GSO by adding arbitrary numbers of content identifiers to the GSO. In one embodiment, the content identifiers are represented as <name, value> pairs