THE CELLULAR HIERARCHY INFORMATION MODELING ENVIRONMENT

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1 OVERVIEW

Within the CHIME, information is organized into units called *cells*. The cell is a new type of atomic object, which extends existing distributed object paradigms, such as agents, actors, and proxies. In what follows, we describe some of the important aspects and features of cells.

1.1 CHIME AS OPEN MULTI-AGENT SYSTEM

As a first approximation, one may consider a cell to be a weak agent in the sense proposed by Wooldridge and Jennings [7], i.e. the cell is an object that is autonomous, social, reactive and pro-active. A machine indicates its willingness to host cells by running a special *depot* program. Each cell within the CHIME then resides in some depot process; each depot process manages a set of cells (see figure 1).

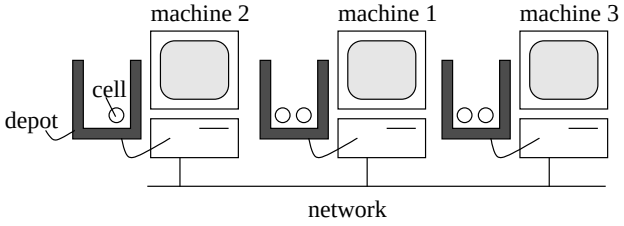

Figure 1: Cells residing in a collection of depots.

The *physical address* of a cell is defined to be the IP address of the machine on which its depot process is running. It is possible for a cell to *migrate* between depot processes on different machines, e.g. a cell can request to change its physical address. In this sense, the CHIME may be considered to be an open multi-agent system.

We use active objects (cells) as the basic quantum of information because:

> **Thesis 1:** *Information must be managed at the level of the active processes generating it,* not *at the level of passive data that is the byproduct of such processes.*

1.2 CHIME AS MULTI-RESOLUTION DISTRIBUTED DATABASE

Unlike traditional agents (see e.g. [2], [5]), the cell is a composite object, i.e. each cell is made up of *sub-cells*, and each cell is a sub-cell of some *super-cell*. Thus cells are organized in a tree, whose nodes (the cells) are distributed across the depots (see figure 2). A cell encapsulates its sub-cells, and is responsible for providing an interface to their information in an aggregated form.

While the Web does permit the organization of information using a directory structure or a tree of hyper-linked pages, there is a fundamental difference: *the Web does not itself interpret the structure of the hyper-links*. In contrast, the CHIME interprets cell hierarchy as follows: *sub-cells represent the internal contents of their super-cell.* Accordingly, if the a user wishes to obtain information at a higher resolution or to see details not presently revealed by a cell, the user simply enters into the cell. The CHIME thus facilitates the efficient partitioning of information, and supports multi-resolution representations.

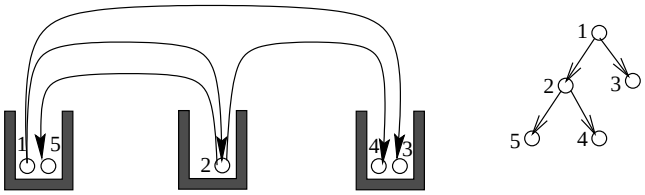

Figure 2: The tree of cells distributed across depots.

Each cell has a name, which remains fixed over its entire lifetime. The *logical address* of a cell *A* is defined to be the dotted sequence of cell names, starting at the root of the CHIME cell tree and ending at the cell *A*. It is possible for a cell to *relocate* within the tree, e.g. a cell can request to change its logical address. Relocation of a cell does not alter its relationships with its sub-cells. Note that relocation and migration are independent notions of mobility.

We use composite objects (cells) as the basic quantum of information because:

> **Thesis 2:** *A scalable solution to the problems of location, management and annotation of information requires maintaining information at multiple*

[6] J. Nelson. *Programming Mobile Objects with Java*. John Wiley and Sons, Inc, 1999.

[7] M. Wooldridge and N. Jennings. Intelligent agents: Theory and practice. *Knowledge Engineering Review*, 10(2):115–152, 1995.