Panel Report: “Main Principles to Guide R&D in Algorithms, Protocols and Middleware”

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Abstract. The panel objective was to discuss with the audience and highlight commonalities and inter-dependencies between the papers presented in the first two sessions of WAC 2004 - **Network Management** and **Models and Protocols**. As this panel was the first one, main discussion tried to define autonomicity, address the more general questions around this new concept and distinguish it from previously introduced and studied concepts.

1 What Is Autonomicity?

Do we need a new formalism, unifying abstraction or new paradigm to describe and manage it?

There was some consensus on the need for a scalable policy language in a highly distributed-based networking scenario, whereas references to agent technology or to active and intelligent networking should be avoided. However fundamental aspects that lead to new networking paradigms need to be effectively addressed first, such as the behavior and cooperation of autonomic entities (based on considerations of economics and game-theoretic approaches) and the self-organizational aspects (and associated effective algorithms).

The issue is not simply the individual autonomic behavior serving self-interest, but how these autonomic, self-driven, individual behaviors lead to a desirable, acceptable global behavior (this is addressed in biology in the context of behavioral ecology). In this respect feedback from the network and control aspects are also important.

We should also clearly articulate to what extent autonomic communications is different from re/auto-configurability, which should be considered as just one aspect of it.

2 Why Do We Need Autonomic Communications?

Internet is indeed complex, but is working pretty well and satisfying a lot of requirements. The following three reasons in favour of development of autonomic communication were expressed during the panel.

First, to cope with the increasing complexity of the Internet by enabling autonomicity, i.e. new networking solutions that facilitate injecting an autonomic component into the network and figuring out automatically what to do with it.

Second, to share the cost of managing networks (this comes from a similar reasoning as to why autonomic computing is needed – IBM's desire not to be burdened with the cost of mainframes).

Third, the cell size is decreasing in mobile wireless networks and such networks proliferate. It is therefore highly desirable to deploy and manage them autonomously and not manually, to reduce the increasing management cost.

3 Is Autonomicity More of a Revolutionary Than an Evolutionary Concept?

To claim that this research is more revolutionary as opposed to evolutionary, it was suggested not to concentrate only on the current or emerging problems it may help solve, but rather try to establish if it fits a possible trend, by looking fairly far into the past of this technology and trying to foresee its future.

60 years ago networks had one or very few owners (in a country or a continent) and this worked well under the circuit-switching paradigm (which did not see any revolution over those years). 30 years ago, the revolutionary packet-switched Internet technology was formed and is managed now by a very large number of distributed entities. Today, we have end users being capable of providing network resources (as routers, storage as content proxies) to networks and becoming themselves the network. Thus, it is conceivable that, several years in the future; the network will basically be built, owned and run by the millions of autonomic end-users. Getting to and managing such networks requires revolutionary steps, which can justify why we need autonomic communications. The trend suggests that it is very likely that autonomic nodes will shape the networking environment in the future, contributing their increasingly powerful resources to it.

Consequently, in addition to developing the concept of autonomicity in order to re-design networking to be more effective in the current and emerging networking environment, we should develop this concept in such a revolutionary way as to capture early enough emerging trends that will lead to entirely new networking environments where autonomic communications would clearly be the paradigm to employ.