Data Centres vs. Community Clouds

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Cloud Computing is a paradigm where users (both end users and developers) are provided with a technology infrastructure (the so called "Cloud") to utilise for their needs. Such infrastructure normally includes, at minimum, a set of machines, but, normally also programming environments (such as Google App Engine) and services (e.g., Hotmail). Todaym Clouds are normally provided by large web-based companies, who have acquired large sets of computing resources for their primary business (e.g., Google), and are re-selling these, expanding into a new market.

The popularity of Cloud Computing is rising fast, requiring the aggregation of ever larger computing resources (called "data centres"). As such, this industry, due to its ever-increasing carbon footprint, is expected to exceed the airline industry by 2020 [3], raising sustainability concerns [6]. The ever increasing carbon footprint comes from the need to constantly provide energy to data centre machines (whether utilised or idle), providing for their cooling and ventilation.

So far the issue of data centre efficiency issue has been tackled by:
- legislation [1, 3]
- the operational limit of power grids (being unable to power anymore servers in their data centres) [7], and
- the potential financial benefits of increased data centre efficiency [3, 5] from maximising resource utilisation [8].

However, [4] points out that the carbon footprint problem of data centres remain [2] since these measures are taken to improve a flawed model of Cloud Computing, in which the resource provision is disconnected from resource consumption. In [4] an alternative approach is proposed where resource consumption and provision are connected, to minimise the environmental impact and allow sustainable growth. In this approach, termed Community Clouds, the centralised data centres are replaced by the shared underutilised resources of the consumer machines themselves. The cloud and community cloud models are contrasted in Fig. 1.

Figure 1.a shows the typical configuration of Cloud Computing at run-time when consumers visit an application served by the central Cloud, which is housed in one or more data centres. Green symbolises resource consumption, and yellow resource provision. The role of coordinator for resource provision is designated by red, and is centrally controlled. In Figure 1.b the role of the vendor in a Cloud is taken on by the consumers themselves. The underutilised resources of the consumers machines are shaped to form a Community Cloud, with nodes potentially fulfilling all roles, consumer, producer, and coordinator.
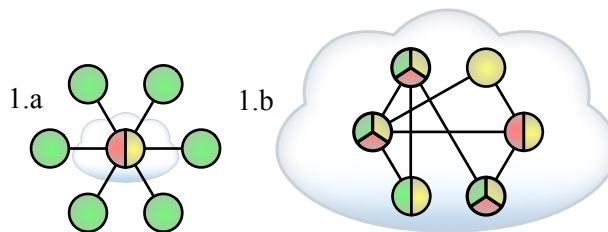

Figure 1: 1.a Traditional Cloud; 1.b Community Cloud. Green symbolises resource consumption, yellow resource provision, and red resource coordination.

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