Interacting with Virtual Plants: a Client-Server Approach

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Abstract

In Functional Structural Plant Modeling a main objective is the comprehension of the interaction between plant morphology and environment, which means the need of developing tools allowing the user to validate a mathematical model on the basis of its graphical output: the Virtual Plant (VP).

In this study a client-server approach has been used to have the VP simulation engine apart from the VP rendering, easy to be used also on the internet, whose parts could be developed apart by different competencies (engine developer, parameter estimator, tester) and using different computing resources (graphics is performed on client machine - see figure 1).
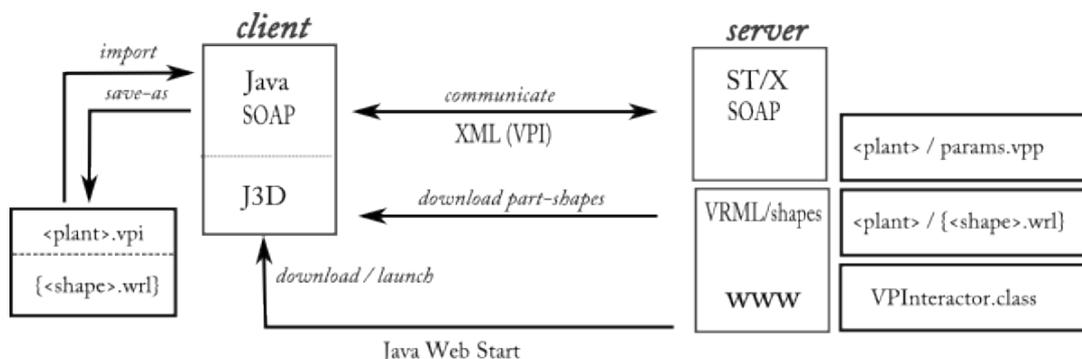
Figure 1 – Architecture of the system

Client and server applications communicate using the SOAP protocol, which is used to exchange XML documents. An XML dialect (Virtual Plant Modeling Language – VPML) has been coined to code statically a plant grown within a give environment (climate) and a time interval. VPML may code a single plantule as much as a full plant history, made of several snapshots taken during the growing period. VPML only maps plant structure, that is how plant modules (internode, bud, petiole, blade) are connected, together with the values of their parameters, both graphical and physiological. Graphic features of plant modules are got from separate VRML files, and used on the client to build-up the VP graphic aspect. The client also allows the user to interact with the virtual plant profiting of the native features of Java3D: user can select, query and prune single modules and submit the modified plant to the server to have it grown to another date.