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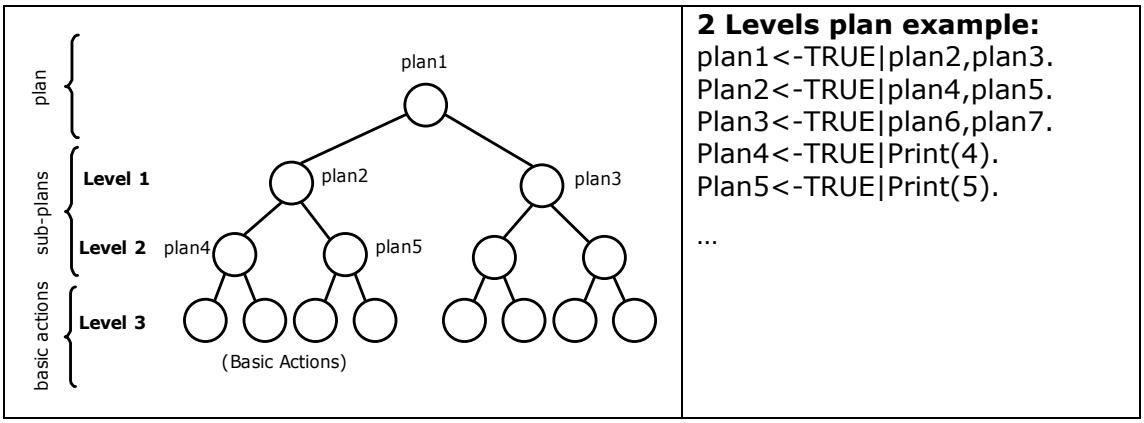
Performance and Capability tests

In order to subsidize the developer with information on the possible 3APL application sizes (number of planning rules) and complexity (deep of planning rules) that can be supported for a specific running environment, we executed a series of capability tests and collected the running parameters. The tests were executed considering the Agents has a plan-rule that is a binary tree and has multiple levels of sub-plans, as presented in Figure \ref{planrule-btree}. The goal is to resolve the root plan (plan1 in the figure), what leads to the resolution of the tree sub-plans until the basic actions at the bottom of the tree are reached. The choice to have a well-structured knowledge structure is intentional, aiming to create a controlled environment for the performance tests.

The more levels, the more complex is the plan resolution and the more plan-rules will be loaded in the plan-rules base. This way we can dimension processing performance and memory usage at same time.



\begin{figure}
\centerline{\includegraphics{figures/ planrule-btree.eps}}
\caption{Plan rule base as a binary tree with multiple levels}
\label{planrule-btree}
\end{figure}

We ran this simulation with several levels of complexity (1-8) in a Java 2 Micro Edition environment and collected the performance and capability values related to number of deliberations per second, used memory, PROLOG machine performance and total execution time. The collected values are presented Figure \ref{j2me-pac-values}(a) along with the graphics that cross-relate memory usage per number of plan rules (Figure \ref{j2me-pac-values}(b)) and deliberations per second versus plan-rule number of levels (Figure \ref{j2me-pac-values}(c)).

(a)

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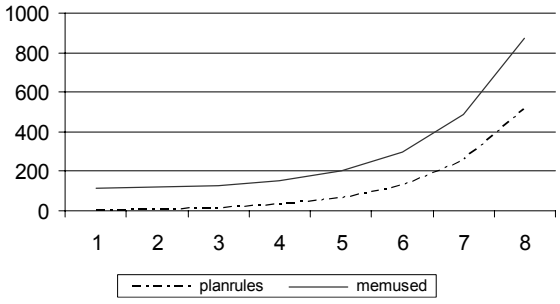
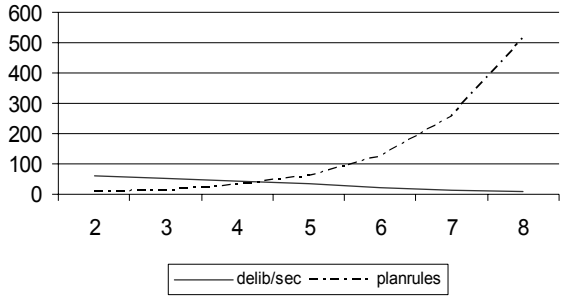
numLeve	runningtime	prologtim	delibs	delib/sec	unify	unify/sec	planrules	memused
0	31	1	2	64.51613	1	1000	0	110.40
1	78	1	5	64.10256	3	3000	3	112.00
2	187	6	11	58.82353	7	1166.667	7	117.32
3	453	12	23	50.77263	15	1250	15	129.37
4	1094	47	47	42.96161	31	659.5745	31	153.48
5	2844	137	95	33.40366	63	459.854	63	201.71
6	8594	341	191	22.22481	127	372.434	127	298.16
7	27673	498	383	13.84021	255	512.0482	255	490.00
8	100404	1106	767	7.639138	511	462.0253	511	875.98

(b)



(c)



\begin{figure}
\centerline{\includegraphics{figures/ j2me-pac-values.eps}}
\caption{Running parameters in Java 2 Micro Edition emulation environment: (a) values spreadsheet, (b) comparison between number of rules and used memory, (c) comparison between complexity of rules and number of deliberations per second}
\label{j2me-pac-values}
\end{figure}

The columns in the table at Figure \ref{j2me-pac-values}(a) are: **numLevels**: number of levels for the plan rule base tree; **runningTime**: total processing time in milliseconds; **prologTime**: processing time by the PROLOG engine; **delibs**: number of deliberation steps to resolve the goal; **delibs/sec**: number of deliberation steps per second (performance); **unify**: number of unifications done by the Prolog engine; **unify/sec**: number of unifications per second; **planrules**: number of Plan Rules loaded in the Agents knowledge base, and **memused**: memory used in Kb.