We have implemented a general framework to handle a wide variety of interactive and automated treatment plan optimization problems. Problems ranging from interactive beam-weight optimization to fully automated optimization of intensity distributions are handled using the same infrastructure. In this report we concentrate on a core feature of all optimization systems: the plan evaluation sub-system. The system reported here allows dynamic specification of both cost functions and constraints before and during optimization. The evaluation sub-system consists of *evaluators*, *modifiers*, and *costlets*, and various ways to combine the costlets to create an overall cost function used by the optimization sub-system. *Evaluators* operate directly on a candidate dose distribution, providing tissue specific metrics (e.g., dose statistics, NTCP/TCP/biological model results, dose-volume constraints). *Modifiers* are functions applied to evaluators to provide flexibility in how the evaluator result is applied (basically a mapping between evaluator space and cost space). Examples of modifiers include floor, ceiling, and piecewise weighting. The result of applying a modifier to the output of an evaluator is a *costlet*. A particular structure can have several costlets. Costlets for different structures are combined according to one of several models (e.g., weighted sum or product) to produce the overall cost or score of the candidate dose distribution. The framework also supports displays for visual validation throughout the optimization process, including DVHs, dose-colorwashes, intensity distribution plots, and costlet/cost trajectories. This presentation will describe the rationale and implementation of this framework and provide clinical examples of its use. *Work supported in part by* NIH P01-CA59827.