Classes for the Observatory Simulator and Scheduler Packages

This document is intended to provide an initial design of the class structure for the newly divided Observatory Simulator and Scheduler packages. The goal is to identify the classes, their responsibilities and their communication with other classes. That communication should detail to which class and what information is transferred.

Observatory Simulator Package

Observatory Simulator

Responsibilities

- Simulate the behavior, commands and telemetry of the observatory as needed for the Scheduler operations.
- Implement different configurations for the system and the survey to simulate the operations in different test cases.

Inputs

- Targets Telemetry
- Configuration Parameter Telemetry
- Scheduler Telemetry

Outputs

- Control Telemetry
- Visits Telemetry
- Environmental Telemetry
- Observatory Telemetry
- Image Quality Telemetry
- History Telemetry

Simulation Kernel

Responsibilities

- Overall coordination of simulation activities
- Coordinate Time, Sequencer and telemetry
- Provide Control telemetry when required
- Simulate the execution of a visit

Inputs

- Next target(s)
- Downtime data

Outputs

- Control Telemetry
    - Configuration Parameters
    - Operational Mode
    - Downtime Telemetry
    - Degraded Mode
    - Time

- Visit

Timer

Responsibilities

- Handles time signal creation and synchronization for simulation

Inputs

- None

Outputs

- Time signal

Sequencer

Responsibilities

- Command “observation” based on current target

Inputs

- Time
- Current target

Outputs

- Visit Telemetry
- Information to Survey database

Downtime Model

Responsibilities

- Tracks scheduled and unscheduled downtime
- Provides downtime data when appropiate

Inputs

- Time
- Configuration for Downtimes

Outputs

- Downtime data

Observatory Model

Responsibilities

- Provide observatory related telemetry when required

Inputs

- Time
- Configuration Parameter
- Sequencer information

Outputs

- Observatory Telemetry

Environment Model

Responsibilities

- Provides environmental and forecast telemetry when required
    - Clouds (Transparency)

    - Seeing
    - Weather

Inputs

- Time
- Configuration Parameter Telemetry

Outputs

- Environmental Telemetry
- Forecast Telemetry
- Survey DB related output

Survey Database

Responsibilities

- Record telemetry information into database
- Provide any derivable quantities from received information
- Provide mechanism to retrieve past observations
- Provide information for starting a science proposal after survey start

Inputs

- Visits
- Targets Telemetry
- Scheduler Telemetry
- Observatory Model Telemetry
- Environment Model Telemetry

Outputs

- History of Visits Telemetry (when queried at Scheduler start-up)

Image Quality Model

Responsibilities

- Simulate and provide image quality parameter telemetry when required

Inputs

- Time
- Enviromental Information
- Observatory Information
- Visits Telemetry

Outputs

- Image Quality Telemetry

Scheduler Package

Scheduler

Responsibilities

- Generate the schedule for the observatory
- Operate in normal control environemt as well as accelerated simulation environment.

Inputs

- Control

- Telemetry
- Visits
- Image Quality
- History

Outputs

- Targets
- Scheduler Telemetry

Scheduling Data

Responsibilities

- Collating observing parameters for targets
- Handles generating look-ahead information

Inputs

- Time
- Telemetry/Forecast
- Astronomical Sky Data

Outputs

- Augmented candidate list of available targets

Conductor Optimizer

Responsibilities

- General coordination of the Scheduler components
- Evaluate cost functions based on provided telemetry and targets
- Use optimization algorithm to decide and schedule the next target

Inputs

- Control/Time
- Control/Config
- Control/Mode
- Control/Downtime
- Control/Degraded
- Lists of ranked targets from Science Programs
- Look-Ahead data from Scheduling Database
- Slew Times from Observatory Kinematic Model

Outputs

- List of Target(s)
- Scheduler Telemetry

Observatory Kinematic Model

Responsibilities

- Simulate the observatory components involved in the slews and visits (mount, rotator, dome, optics and camera)
- Synchronize the internal model with the observatory telemetry
- Provide the slew time estimation for the target candidates

Inputs

- Telemetry/Observatory conditions
- Telemetry/Environment conditions
- Control/Config

Outputs

- Slew times

Astronomical Sky

Responsibilities

- Provide coordinates for Sun, Moon and bright Planets
- Provide Sky Brightness

Inputs

- Configuration Parameter Telemetry

Outputs

- Sky Brightness
- Celestial Body Coordinates

Observations History

Responsibilities

- Collection of past visits including parameters and conditions present at the time of observation
- Provide information for ranking future targets for proposals

Inputs

- Image Quality Telemetry
- Past Observation Telemetry
- Visit Telemetry

Outputs

- List of Visits

Science Programs

Responsibilities

- Propose targets with a corresponding rank value

Inputs

- Environmental Telemetry
- Observation History Telemetry

Outputs

- Candidate lists of targets according to rank