Science Goals for Time-Domain:

- Maximize identification of all variable objects (~1000/night after 1st year) to understand all levels of variability, discover rare,unusual phenomena
- Use time-critical followup to understand the nature,physical process and effects of the variation on the underlying stars
  e.g. SN – categorize & calibrate as standard candles (same-day-months, 10000)
  Novae – understand the shell expansion, O,NeMg type (days-months, 20/yr)
  GRB process (min-days, 100/yr)
  State of accretion disks at low states and during transitions (weeks, dozens)
  AGN stellar disruption events, followup of rev mapping (months, few)
- Use long term followup after light curves complete (1-5 yr) to determine stellar population statistics, stellar evolution, oddities in a class, parameters (metallicity) due to location in the galaxy or differences between galaxies
  e.g. differentiate different kinds of Cepheids – few thousand
  find end products of close binary evolution (RVs, components) - hundreds

Capabilities Needed for Time-Domain:

- Need precursor commuity programs to test spatial densities, filtering, rapid response (now and during 2nd commissioning year of LSST) to have time domain ecosystem in place at start.
- Event broker (software infrastructure to filter alerts) in order to distinguish known/unknown transients from alert stream.
- Low resolution (r~100-500) spectra(~200/night) to classify peculiar/unknown objects, narrow target selection to ~10/night. Instrument like the SED machine or FLOYDS on a 2m (for r~20) and 4m (r~22).Rapid data reduction pipeline critical. Need about 10000 objects/yr including followup.
- Moderate resolution(r~3000-5000) with wide wavelength coverage (atm cutoff to K band) on 4m and 8m telescopes for science (understanding variabilty process,radial velocity, metallicity, g, T) of a few thousand selected targets/yr with multiple spectra for many to follow variation. Anticipated frequency and distribution of transient targets needed to assess costs/benefits of multi-object vs single-object (or small field IFU) spectrograph. Envision 20-30m about 100/yr.
- Rapid (hour-same day) response need for faint and fast objects (.Ia or Ca-rich transients, LIGO targets). Need change of observatory operation modes to enable spectra on demand (dedicated facilities, queue scheduling, TOO interrupts) over all apertures. Standard TOO programs over variety of timescales.