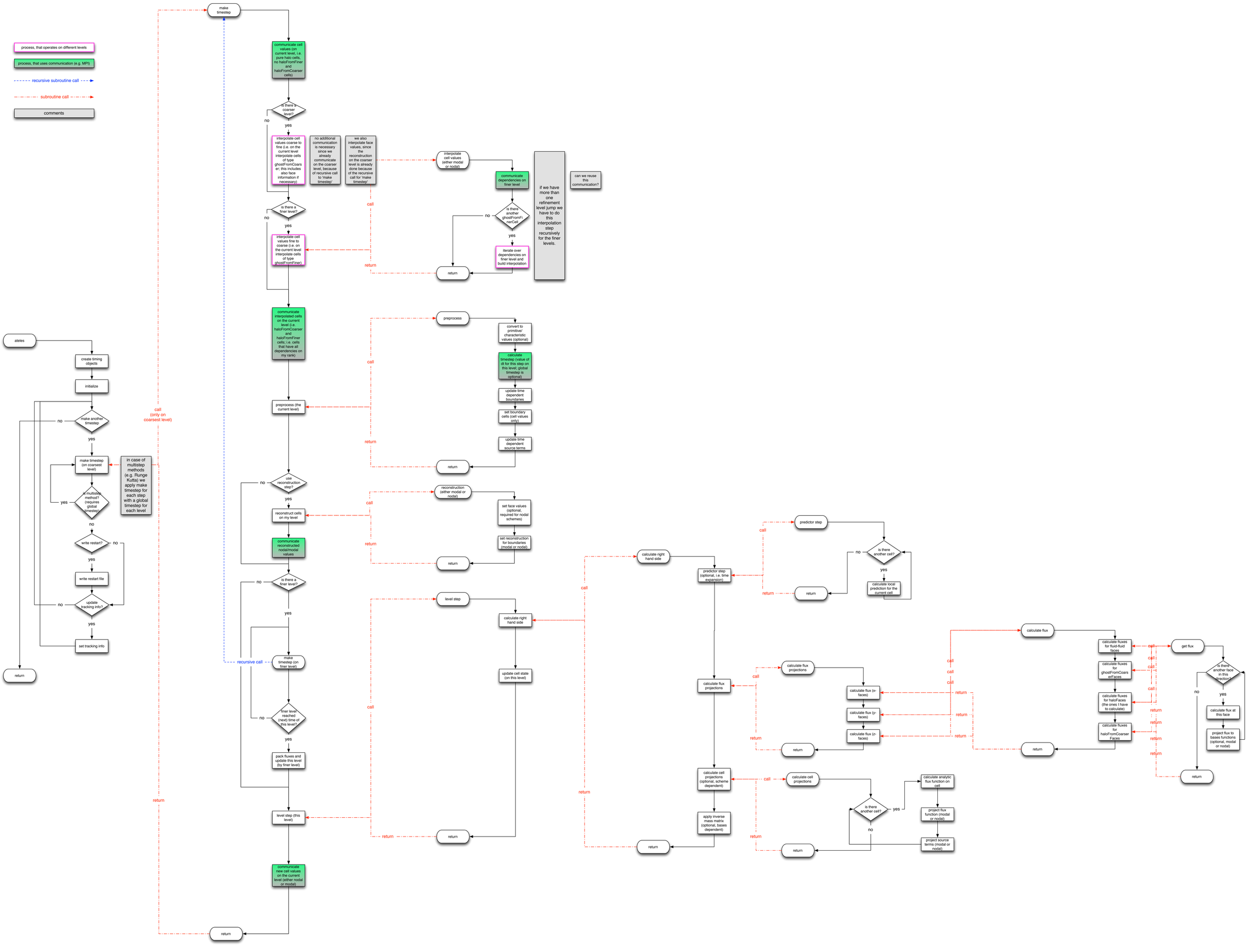
process, that operates on different levels
process, that uses communication (e.g. MPI)
recursive subroutine call
subroutine call
comments
ateles
create timing objects
initialize
make another timestep
no
yes
make timestep (on coarsest level)
in case of multistep methods (e.g. Runge Kutta) we apply make timestep for each step with a global timestep for each level
is multistep method? (requires global timestep)
yes
no
write restart?
no
yes
write restart file
update tracking info?
no
yes
set tracking info
return
call (only on coarsest level)
return
make timestep
communicate cell values (on current level, i.e. pure halo cells, no haloFromFiner and haloFromCoarser cells)
is there a coarser level?
no
yes
interpolate cell values coarse to fine (i.e. on the current level interpolate cells of type ghostFromCoarser; this includes also face information if necessary)
no additional communication is necessary since we already communicate on the coarser level, because of recursive call to 'make timestep'
we also interpolate face values, since the reconstruction on the coarser level is already done because of the recursive call for 'make timestep'
call
interpolate cell values (either modal or nodal)
communicate dependencies on finer level
is there another ghostFromFinerCell
no
yes
iterate over dependencies on finer level and build interpolation
return
return
if we have more than one refinement level jump we have to do this interpolation step recursively for the finer levels.
can we reuse this communication?
is there a finer level?
no
yes
interpolate cell values fine to coarse (i.e. on the current level interpolate cells of type ghostFromFiner)
communicate interpolated cells on the current level (i.e. haloFromCoarser and haloFromFiner cells; i.e. cells that have all dependencies on my rank)
call
preprocess
convert to primitive/ characteristic values (optional)
calculate timestep (value of dt for this step on this level; global timestep is optional)
update time dependent boundaries
set boundary cells (cell values only)
update time dependent source terms
return
return
preprocess (the current level)
use reconstruction step?
no
yes
call
reconstruction (either modal or nodal)
set face values (optional, required for nodal schemes)
set reconstruction for boundaries (modal or nodal)
return
return
reconstruct cells on my level
communicate reconstructed nodal/modal values
is there a finer level?
no
yes
recursive call
make timestep (on finer level)
finer level reached (next) time of this level?
no
yes
pack fluxes and update this level (by finer level)
level step (this level)
communicate new cell values on the current level (either nodal or modal)
return
call
level step
calculate right hand side
update cell state (on this level)
return
return
call
calculate right hand side
predictor step (optional, i.e. time expansion)
calculate flux projections
calculate cell projections (optional, scheme dependent)
apply inverse mass matrix (optional, bases dependent)
return
call
predictor step
is there another cell?
no
yes
calculate local prediction for the current cell
return
return
call
calculate flux projections
calculate flux (x-faces)
calculate flux (y-faces)
calculate flux (z-faces)
return
return
return
return
return
call
calculate cell projections
is there another cell?
yes
no
calculate analytic flux function on cell
project flux function (modal or nodal)
project source terms (modal or nodal)
return
return
call
calculate flux
calculate fluxes for fluid-fluid faces
calculate fluxes for ghostFromCoarserFaces
calculate fluxes for haloFaces (the ones I have to calculate)
calculate fluxes for haloFromCoarser Faces
return
call
get flux
is there another face in this direction?
no
yes
calculate flux at this face
project flux to bases functions (optional, modal or nodal)
return
call
return