

Example of a Start-Stop application pattern

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  - Check if state was saved
  - Synchronize iterations
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  - Check if stop is flaged
  - Save state at the end

Original application pattern: C-based

```
int main(int argc, char *argv[]){
  …
  MPI_Init(&argc, &argv);
  MPI_Comm_rank(MPI_COMM_WORLD, &mpi_rank);
  MPI_Comm_size(MPI_COMM_WORLD, &mpi_size);

  <syncronize initial data: native proceses>

  while (it <itmax) {

    <Compute and distribute data>

    it++;
  }
  MPI_Finalize();
}
```

Start-stop application pattern: C-based

```
int main(int argc, char *argv[]){
  …
  MPI_Init(&argc, &argv);
  MPI_Comm_rank(ADM_COMM_WORLD, &mpi_rank);
  MPI_Comm_size(ADM_COMM_WORLD, &mpi_size);

  <Check if saved state exists from previous stop>
  <syncronize initial data or saved state: native proceses>
  <Syncronize iterations among processes>

  ADM_MonitoringService (ADM_SERVICE_START);

  while (it < itmax) {
      …
      …
```

Start-stop application pattern: C-based

```
…
while (it < itmax) {
  <Set user malleability hints>

  ADM_MalleableRegion (ADM_SERVICE_START);

  <Compute and distribute data>

  it++;

  status = ADM_MalleableRegion (ADM_SERVICE_STOP);

  <Check if end or stop state achieved>
}
ADM_MonitoringService (ADM_SERVICE_STOP);
< If stop state -> save state>
MPI_Finalize();
< return end or stop flag value >
}
```

Modified sections: Check if state was saved

- Check file <PROGRAM>_ss.iter

```
 …
FILE *fd = fopen(“<PROGRAM>_ss.iter”, "r");
if (fd != NULL) {
  <load iteration state>
  ADM_RegisterSysAttributesInt (”ADM_GLOBAL_ITERATION", &it);
}
 …
```

Modified sections: Check if state was saved

- Check file <PROGRAM>_ss.check

```
 …
FILE *fd = fopen(“<PROGRAM>_ss.check”, "r");
if (fd != NULL) {
  <load and redistribute data state>
} else {
  <init and redistribute initial data>
}
 …
```

Modified sections: Synchronize iterations

- Iteration must be updated just before stopping malleable region.

```
…
ADM_RegisterSysAttributesInt(”ADM_GLOBAL_MAX_ITERATION",
                                &itmax);
ADM_GetSysAttributesInt(”ADM_GLOBAL_ITERATION", &it);
…
while (it < itmax) {
  …
  ADM_RegisterSysAttributesInt(”ADM_GLOBAL_ITERATION", &it);
  status = ADM_MalleableRegion (ADM_SERVICE_STOP);
  …
```

Modified sections: Set user hints

- Hints are reset after starting every malleable region

```
…
while (it < itmax) {
  …
  if (<condition to expand/shrink>) {
    ADM_RegisterSysAttributesInt(
                  ”ADM_GLOBAL_HINT_NUM_PROCESS", &proc_hint);
    ADM_RegisterSysAttributesInt(
                  ” ADM_GLOBAL_HINT_EXCL_NODES", &excl_hint);
  }
  …
```

Modified sections: Check if stop is flaged

- Iteration must be updated just before stopping malleable region.

```
…
while (it < itmax) {
   …
      status = ADM_MalleableRegion (ADM_SERVICE_STOP);
      if (status == ADM_STARTSTOP) {
            ret_val = 2;
      break;
   }
}
…
```

Modified sections: Save state at the end

- If ends with stop state: save iteration and data state.

```
…
if (ret_val == 2) {
   <save iteration state: <PROGRAM>_ss.iter >
   <save data state: <PROGRAM>_ss.check >
}
return (ret_val);
}
```

Unlocking malleability in HPC applications

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