

OpenSees: Status and Developments

Frank McKenna

*Department of Civil and Environmental Engineering
University of California, Berkeley*

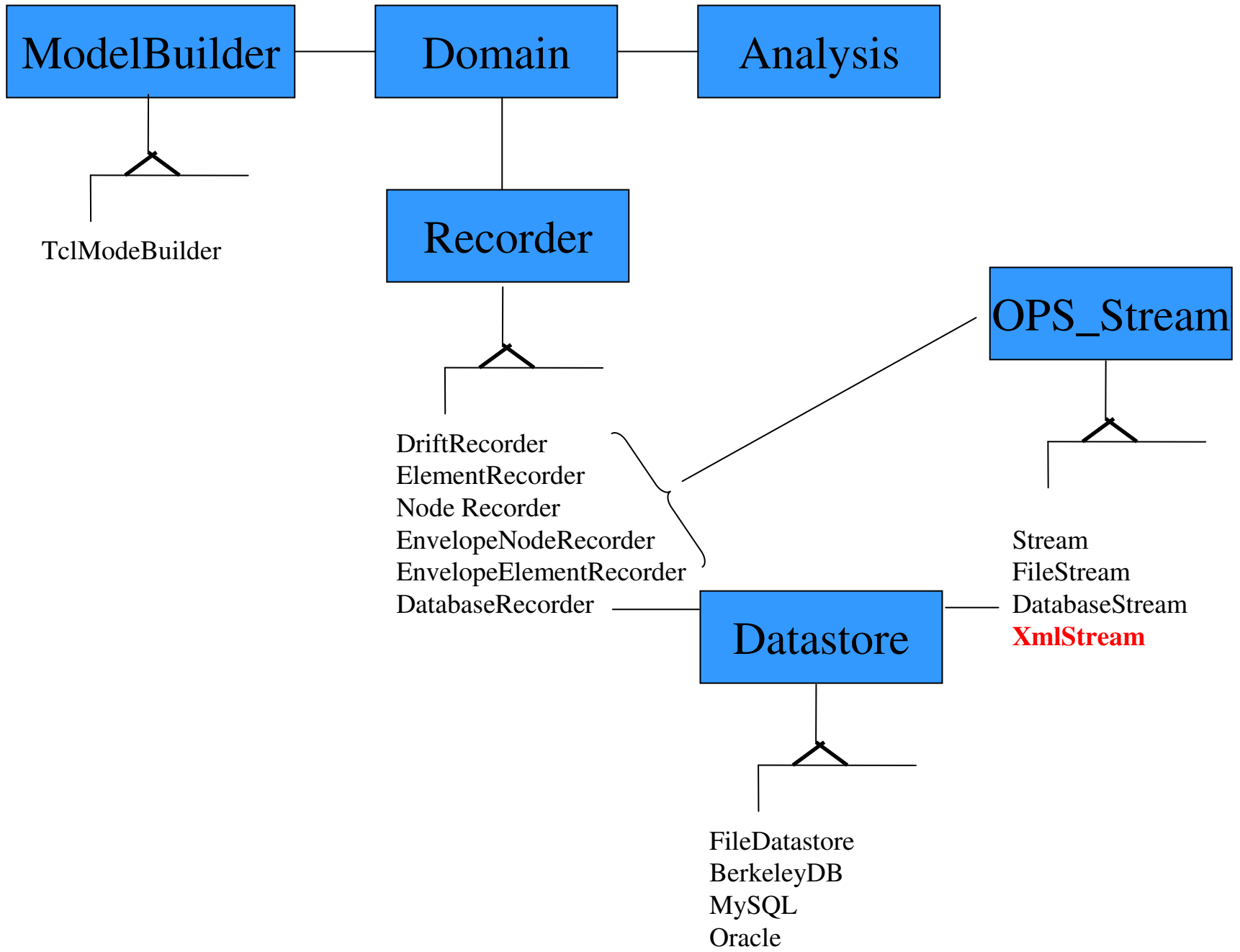
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and through NEESit



Current Status 1.7.3:

- Lets look at what we currently have in the OpenSees framework.



```
<?xml version="1.0" encoding="UTF-8"?>
<OpenSees
  xmlns:xsi = "http://www.w3.org/2001/XMLSchema-instance"
  xsi:noNamespaceSchemaLocation = "http://OpenSees.berkeley.edu/xml-schema/xmlns/OpenSees.xsd">

<OpenSeesOutput>
  <TimeOutput>
    <ResponseType>time<ResponseType/>
  </TimeOutput>

  <NodeOutput nodeTag="3" coord1="0.000000" coord2="144.000000" coord3="0.000000">
    <ResponseType>D1<ResponseType/>
    <ResponseType>D2<ResponseType/>
    <ResponseType>D3<ResponseType/>
  </NodeOutput>

  <NodeOutput nodeTag="4" coord1="360.000000" coord2="144.000000" coord3="0.000000">
    <ResponseType>D1<ResponseType/>
    <ResponseType>D2<ResponseType/>
    <ResponseType>D3<ResponseType/>
  </NodeOutput>

  <Data>
    0.100000 0.000000 -0.001804 -0.000000 0.000000 -0.001804 -0.000000
    0.200000 0.000000 -0.003614 -0.000000 0.000000 -0.003614 -0.000000
    0.300000 0.000000 -0.005433 -0.000000 0.000000 -0.005433 -0.000000
    0.400000 0.000000 -0.007258 -0.000000 0.000000 -0.007258 -0.000000
    0.500000 0.000000 -0.009091 -0.000000 0.000000 -0.009091 -0.000000
    0.600000 0.000000 -0.010932 -0.000000 0.000000 -0.010932 -0.000000
    0.700000 0.000000 -0.012781 -0.000000 0.000000 -0.012781 -0.000000
    0.800000 0.000000 -0.014637 -0.000000 0.000000 -0.014637 -0.000000
    0.900000 0.000000 -0.016501 -0.000000 0.000000 -0.016501 -0.000000
    1.000000 0.000000 -0.018374 -0.000000 0.000000 -0.018374 -0.000000
  </Data>
</OpenSeesOutput>
```

```
<?xml version="1.0" encoding="UTF-8"?>
<OpenSees
  xmlns:xsi = "http://www.w3.org/2001/XMLSchema-instance"
  xsi:noNamespaceSchemaLocation = "http://OpenSees.berkeley.edu/xml-schema/xmlns/OpenSees.xsd">

<OpenSeesOutput>
  <TimeOutput>
    <ResponseType>time<ResponseType/>
  </TimeOutput>

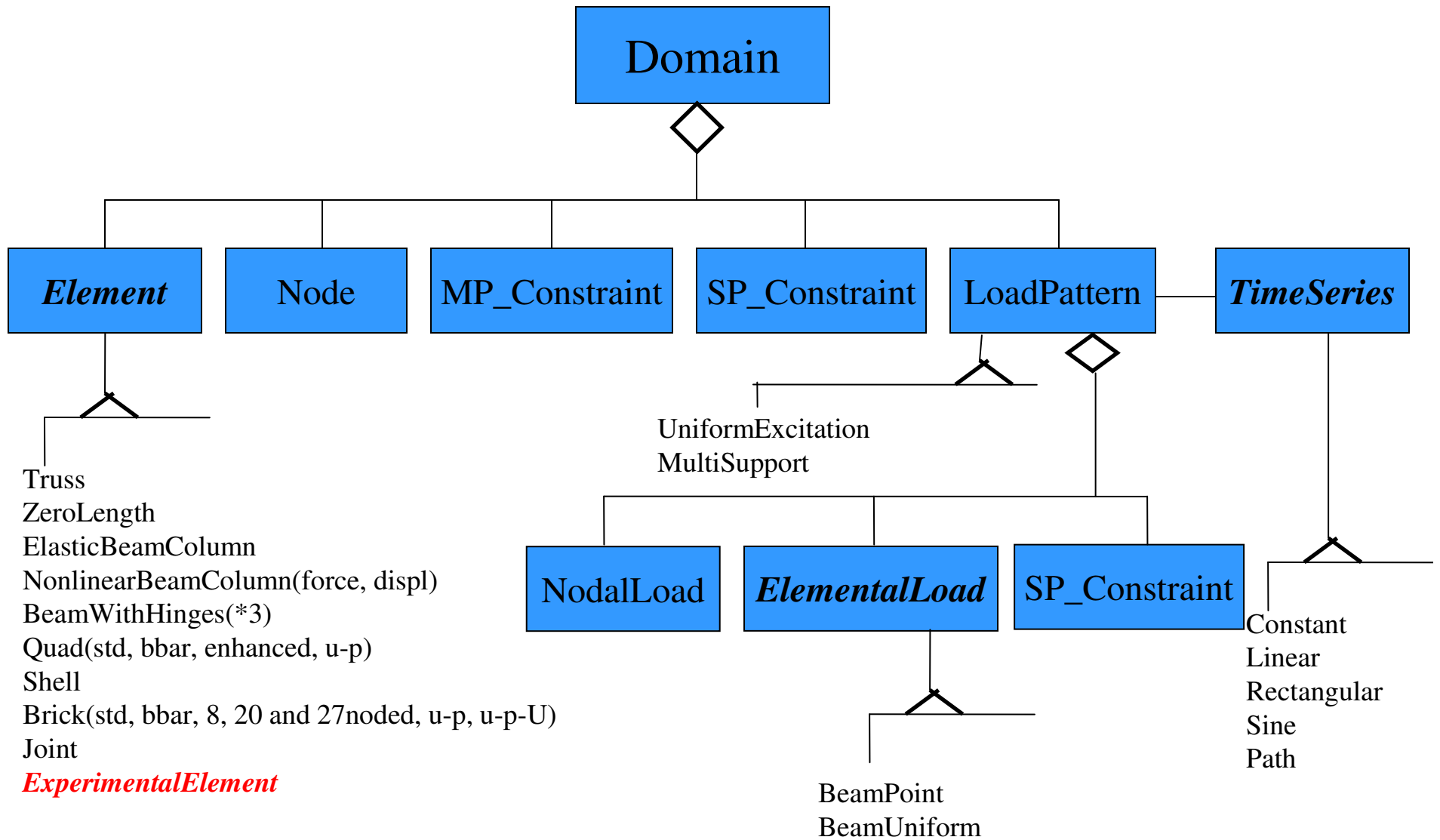
<ElementOutput eleType="ForceBeamColumn2d" eleTag="1" node1="1" node2="3">
  <GaussPointOutput number="5" eta="1.000000">
    <SectionOutput secType="FiberSection2d" secTag="1">
      <FiberOutput yLoc="-7.350000" zLoc="0.000000" area="25.200000">
        <UniaxialMaterialOutput matType="Concrete01" matTag="1">
          <ResponseType>sigma11<ResponseType/>
        </UniaxialMaterialOutput>
      </FiberOutput>
    </SectionOutput>
  </GaussPointOutput>
</ElementOutput>

<ElementOutput eleType="DispBeamColumn2d" eleTag="2" node1="2" node2="4">
  <GaussPointOutput number="5" eta="0.906180">
    <SectionOutput secType="FiberSection2d" secTag="1">
      <FiberOutput yLoc="-7.350000" zLoc="0.000000" area="25.200000">
        <UniaxialMaterialOutput matType="Concrete01" matTag="1">
          <ResponseType>sigma11<ResponseType/>
        </UniaxialMaterialOutput>
      </FiberOutput>
    </SectionOutput>
  </GaussPointOutput>
</ElementOutput>

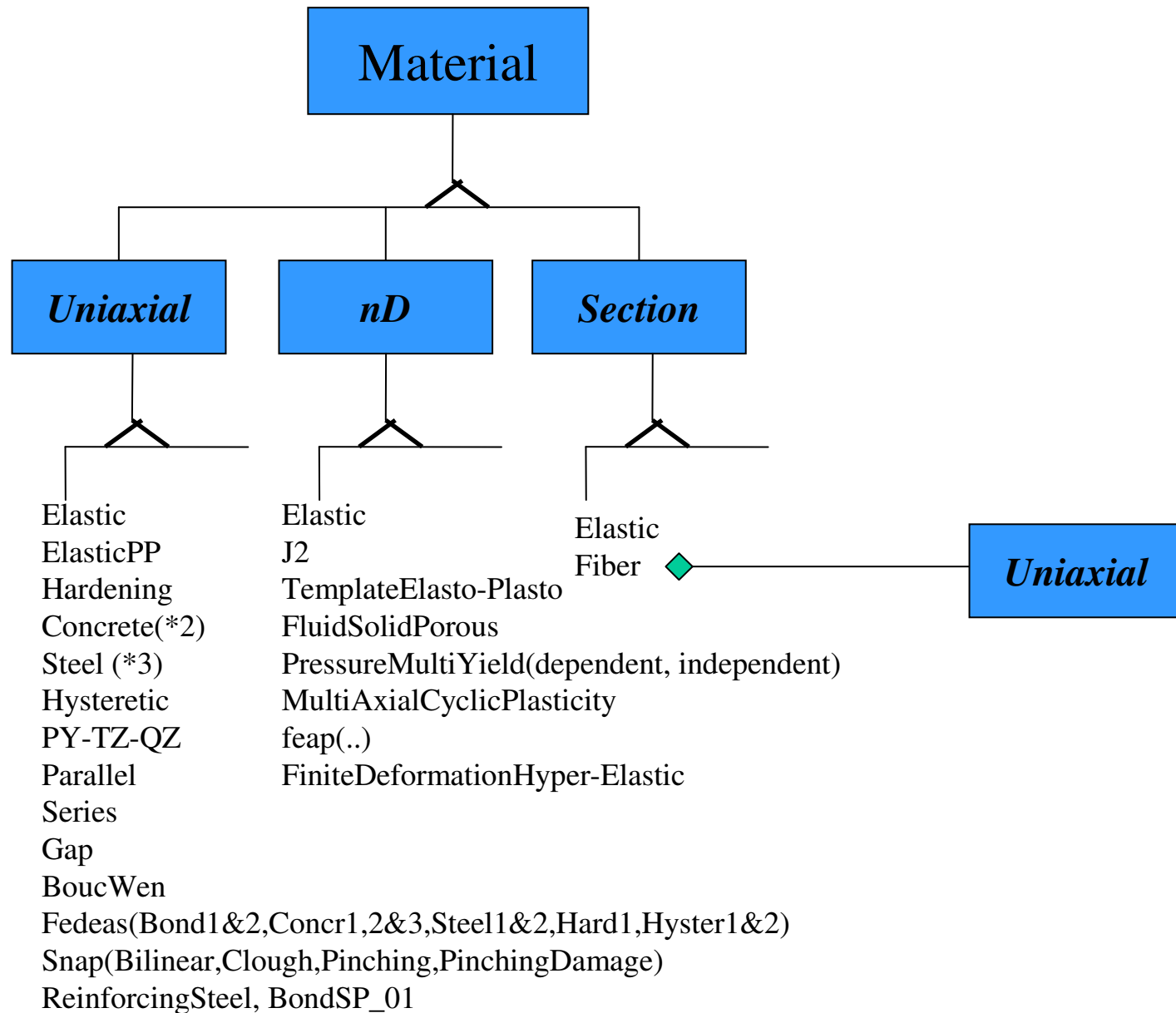
<ElementOutput eleType="ElasticBeam2d" eleTag="3" node1="3" node2="4"/>

<Data>
  0.100000 -0.037516 -0.037516
  0.200000 -0.075065 -0.075065
  0.300000 -0.112647 -0.112647
  0.400000 -0.150262 -0.150262
  0.500000 -0.187911 -0.187911
  0.600000 -0.225594 -0.225594
```

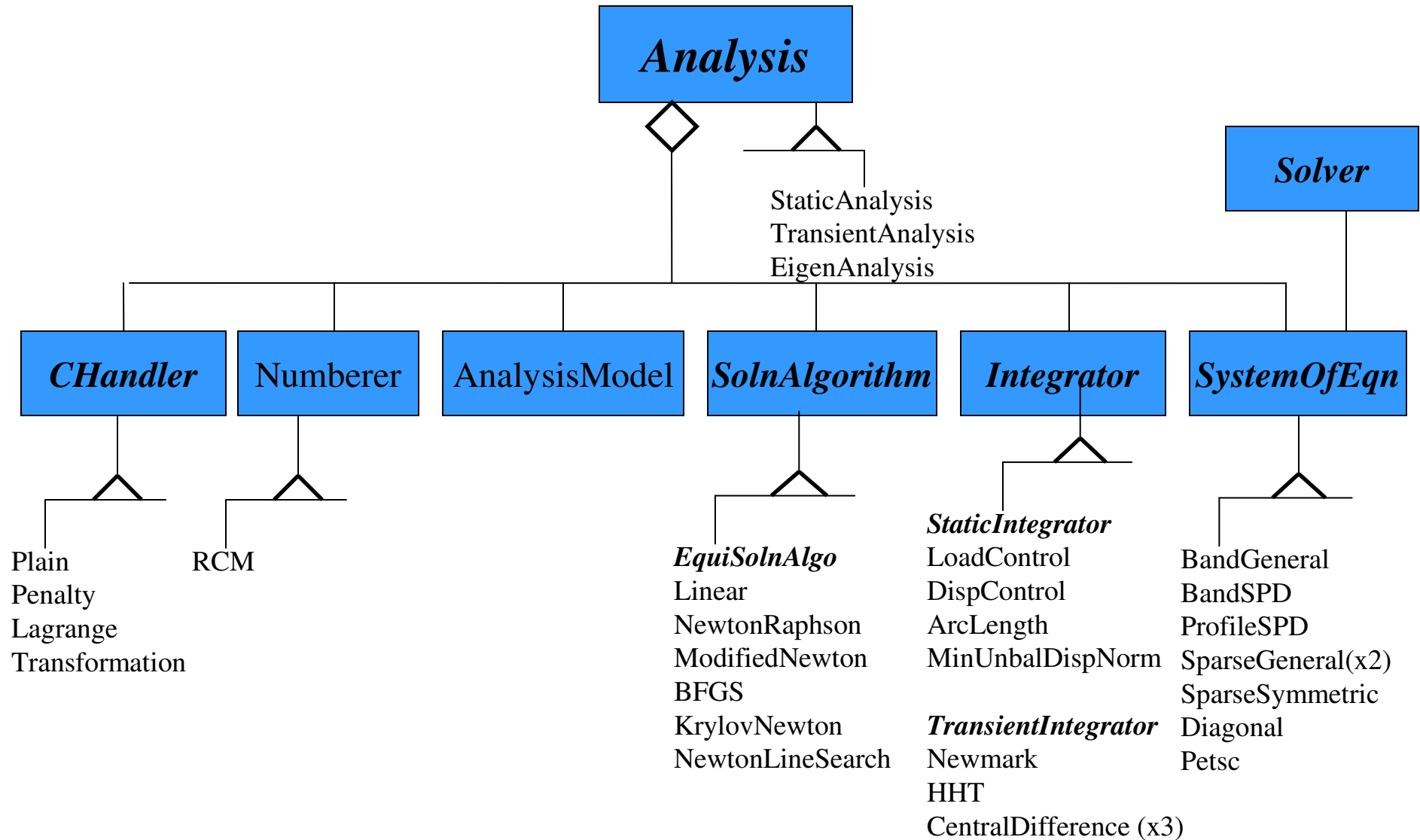
Domain Classes:



Material Classes:



Analysis Classes:



Parameter Studies

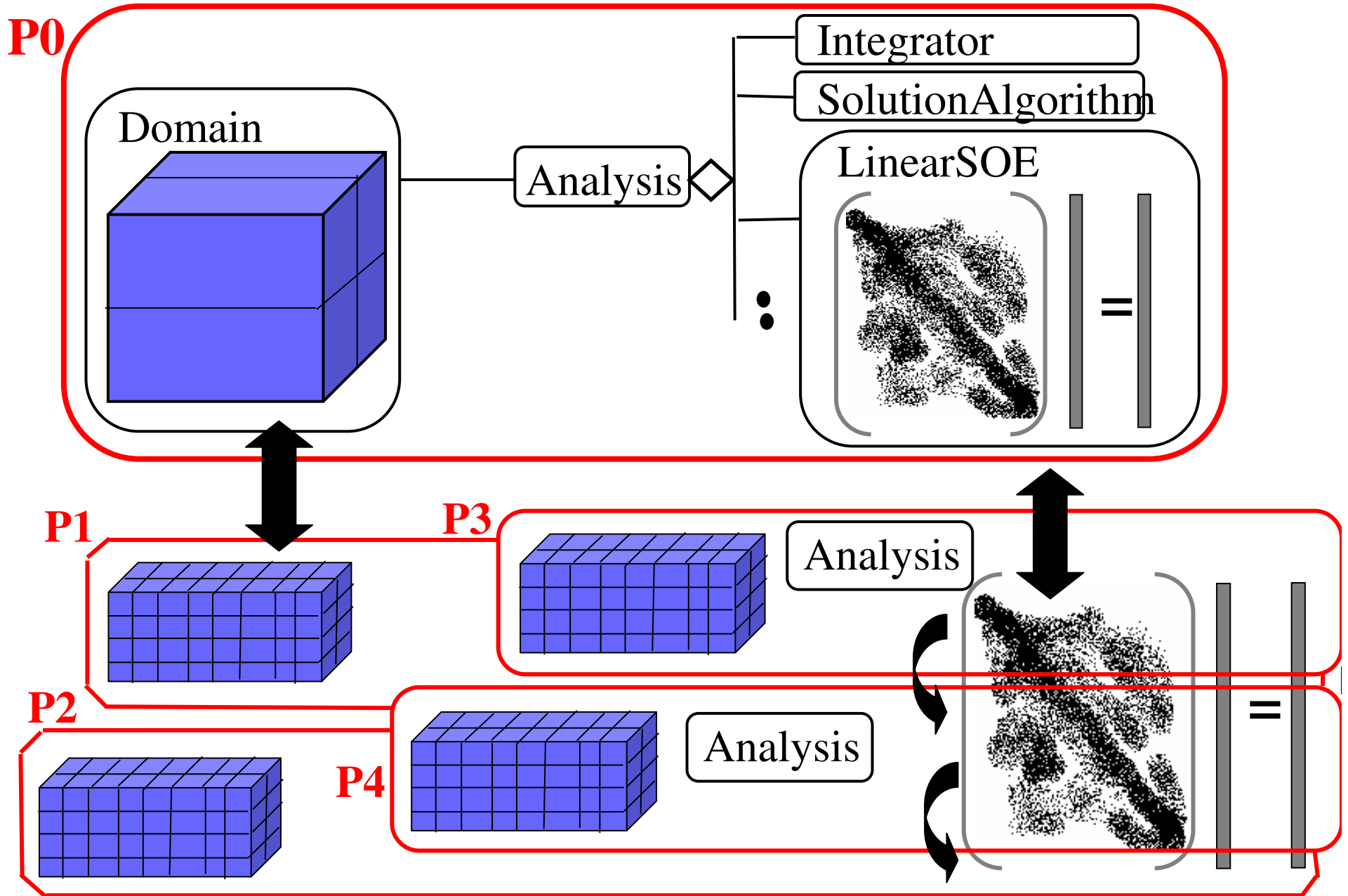
```
OpenSees example1.tcl -par parName1? file1? parName2? file2?□
```

Parallel Processing

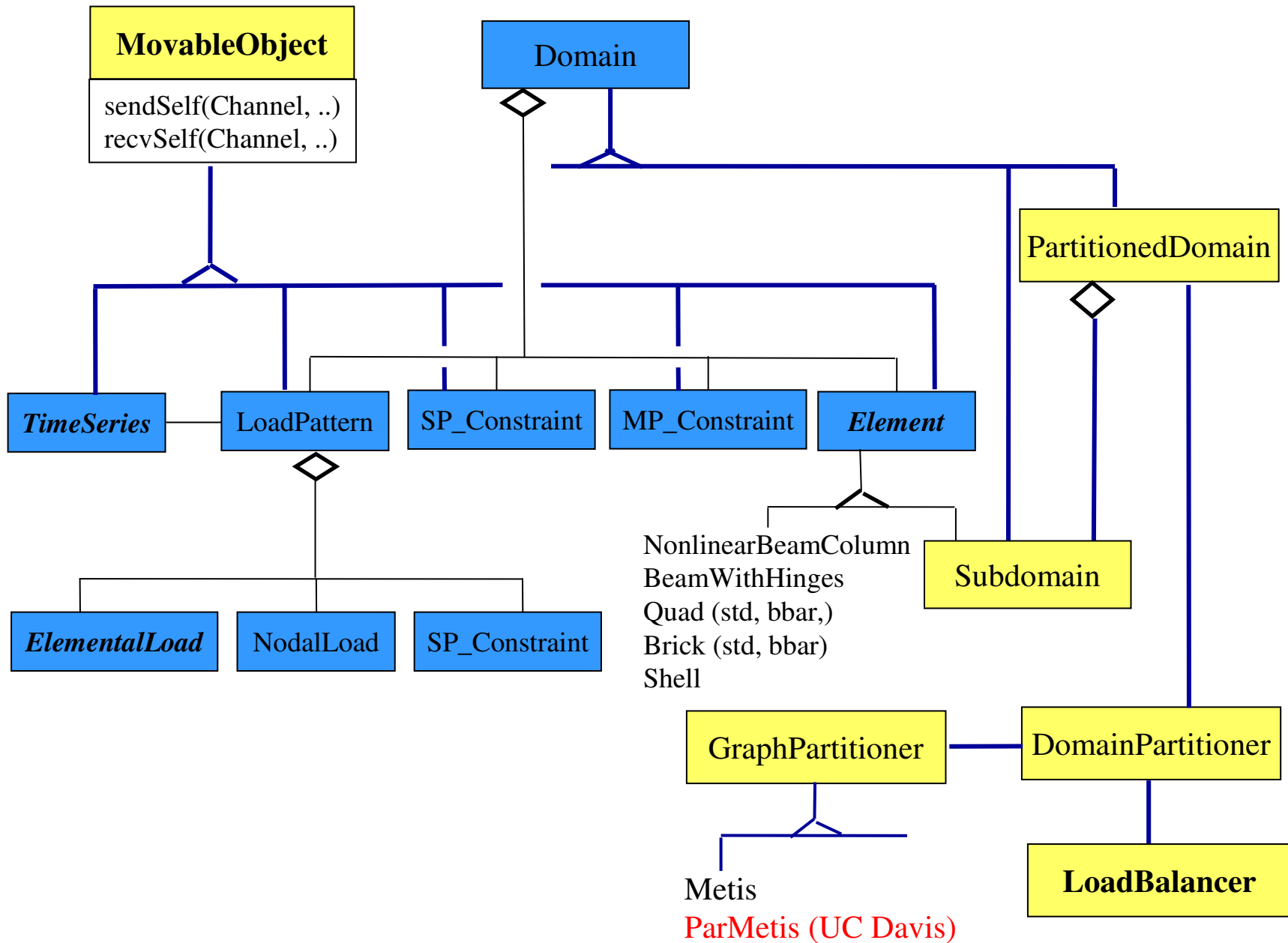
- OpenSees can be built to run on parallel machines containing an implementation of MPI.
- 2 Parallel Versions:
 - One for large simulations uses domain decomposition methods.
 - The other is for many small simulations, parameter studies and uses the interface just described.

Which is built currently depends on the
PROGRAMMING_MODE set in Makefile.def

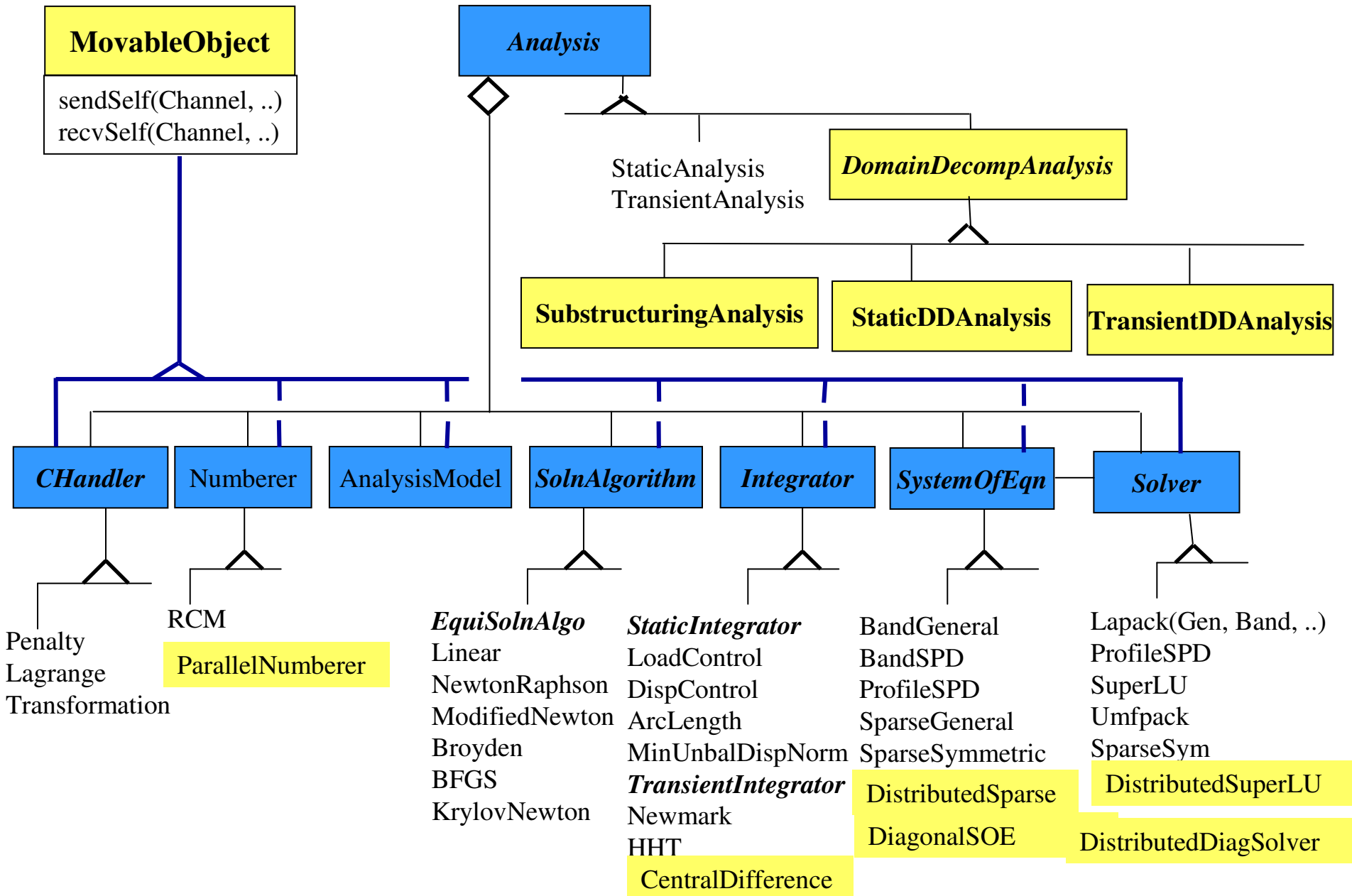
Parallel OpenSees for Large Simulation



Domain Classes for Parallel FE



Analysis Classes for Parallel FE



□ Changes in Certain Command Routines for OpenSeesMPI.exe

- In some of the tcl command routines there are `#ifdef _PARALLEL_PROCESSING`

```
int specifySOE(ClientData clientData, Tcl_Interp *interp, int argc, TCL_CHAR **argv)
{
    ...
    else if (strcmp(argv[0], "BandGeneral")) {
        BandGenLinSolver *theSolver = new BandGenLinSolver();
#ifdef _PARALLEL_PROCESSING
        theSOE = new DistributedBandGenLinSOE(theSolver);
#else
        theSOE = new BandGenLinSOE(theSolver);
#endif
    }
    ...
}
□
```

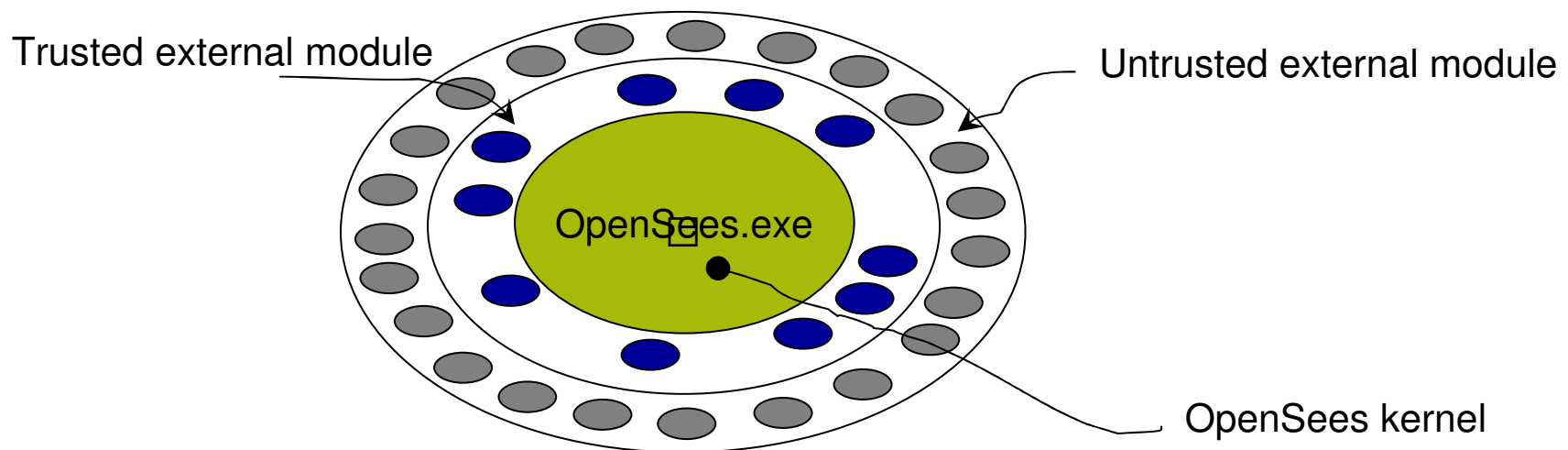
What Else is Needed?

Repackaging of OpenSees:

Why?

- The Repository is getting rather large.
- Not everyone is using everything that's in there.
- Not everyone is willing to submit their code.
- Not all the code that is submitted is tested and/or documented.
- **Different versions are beginning to pop up.**

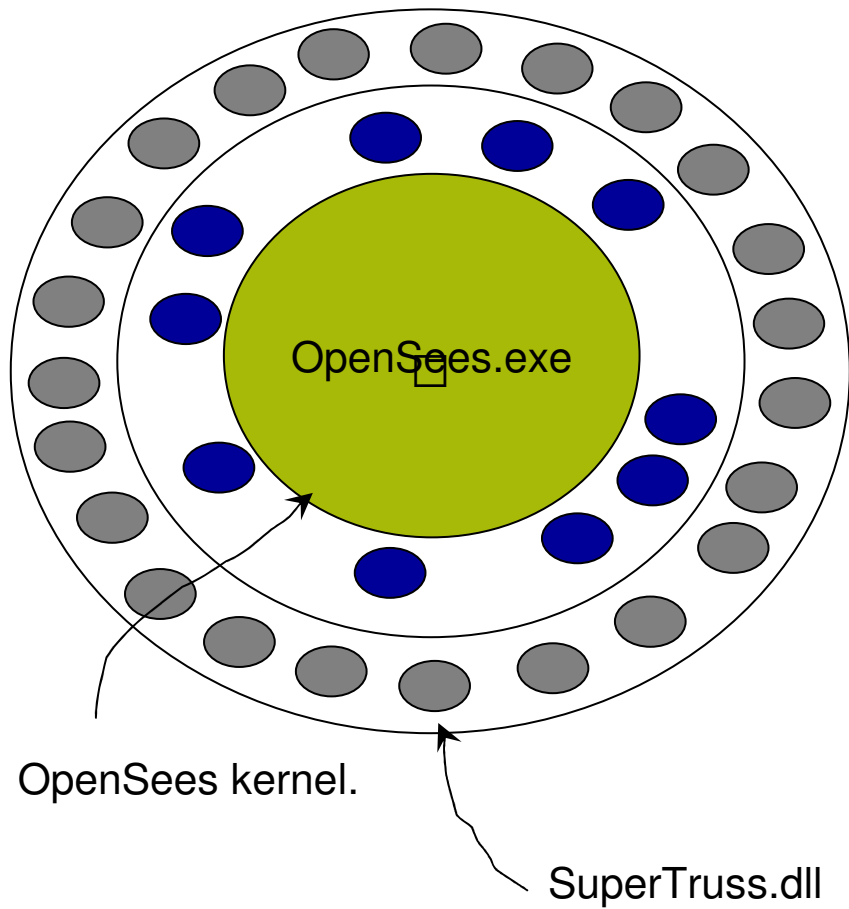
What Will OpenSees.exe Look Like:



So How Will We Get Stuff Outside In:

3 Approaches:

1. User downloads additional functionality in form of .lib or source files. User build or Smart build process which would generate some code, compile & link with kernel.
2. User or Smart download of additional functionality in form of .dll. Running kernel when comes across item of type unknown searches LD_LIBRARY_PATH for .dll (.so) and loads it if finds it.
3. Both 1 and 2.



TclElementCommands.cpp

```

if (strcmp(eleType, "truss") == 0) {
    return TclCommand_Truss(...);
} else if (strcmp(eleType, "forceBeamColumn") == 0) {
    return TclCommand_ForceBeamColumn(...);
} else {
    theEleCommands = theExtraElementCommands;
    while (theEleCommands != 0) {
        if (strcmp(eleType, theEleCommands->type) == 0)
            return (*(theEleCommands->funcPtr)(...)
        else
            theEleCommands = theEleCommands->next;
    }
    int (*funcPtr)(...)
    int res = getLibraryFunction(eleType, &funcPtr);
    if (res != 0) {
        theExtraEleCommands.add(eleType, &funcPtr);
        return (*(funcPtr)(...)
    } else
        return 0;
}

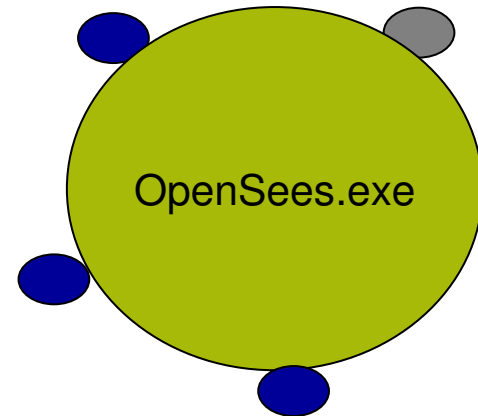
```

Example.tcl

```

element truss 1 ...
element truss 2 ...
element SuperTruss 3 ...
element SuperTruss 4 ...

```



Where Will Packages Be Found?

- Packages Could Have a Website

- A Search by trustworthiness, category, keywords would bring up a page containing information and links to actual packages:

Level: 2
Category: Element
Description: BeamWithHinges Element
Theory: <http://www.mmu.edu/~mhs/beamwithHinges.pdf>
Contact: mhs@mmu.edu
Download: <http://www.mmu.edu/~mhs/beamWithHinges.bz>
Examples: <http://www.mmu.edu/~mhs/beamWithHingesExamples.pdf>
Reviews:

- Give Developers ability to Add and Remove their own work.
- Give Others the ability to Download and Review.

- Real World Examples:

fink: <http://fink.sourceforge.net>

Zdnet: <http://downloads-zdnet.com.com>

Cnet: <http://www.download.com>

Versiontracker: <http://www.versiontracker.com>

Anything Else?