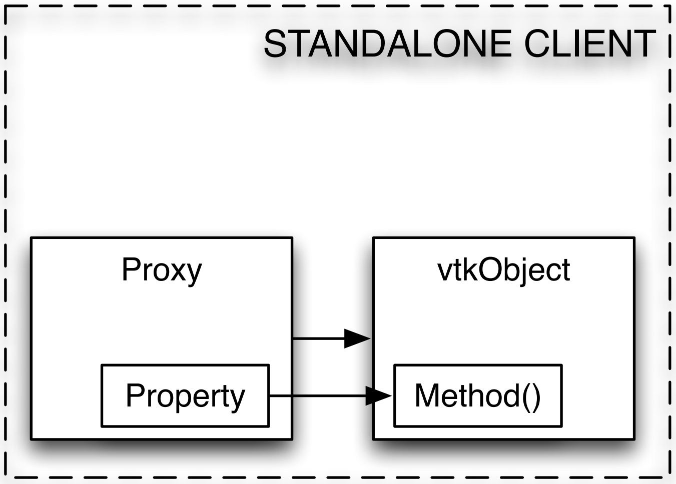
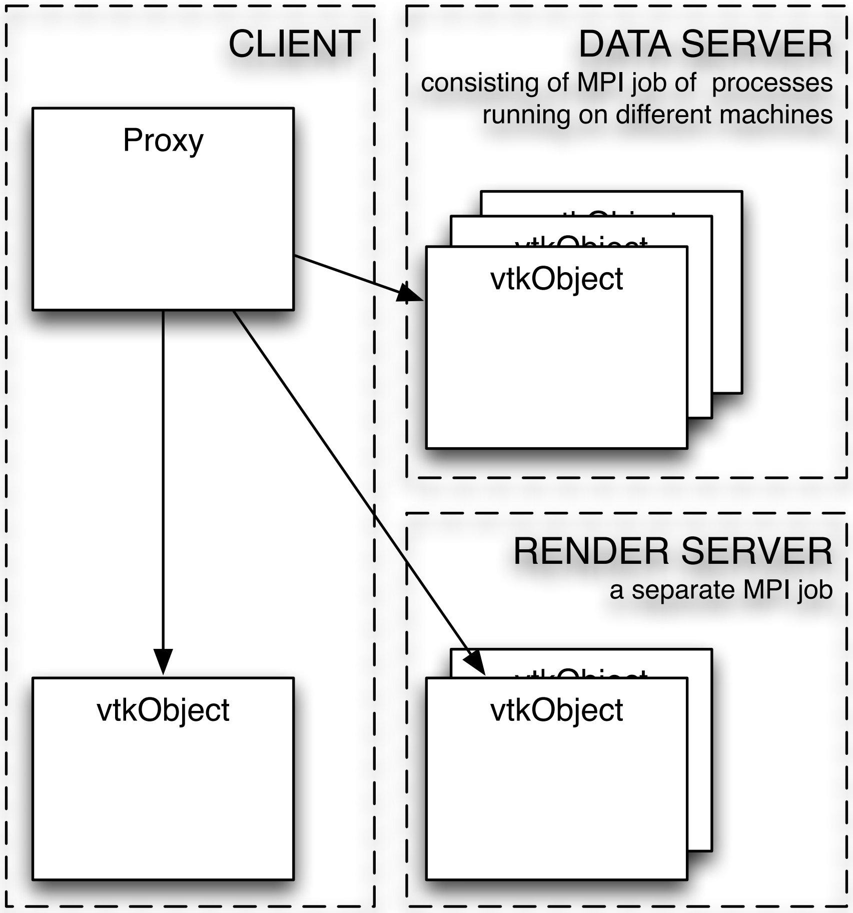




ParaView uses Proxies to control vtkObjects.
A Proxy's Properties control individual Methods on the Object.

The proxies give configuration independence to the application code. The same call to control a proxy works whether the Object lives inside the same process or on remote and possibly parallel processes, or both.

A vtkProcessModule enum determines where the object controlled by the proxy lives. The default is on the data server, but it can be on every process or on particular ones.

Proxy C++ class inheritance

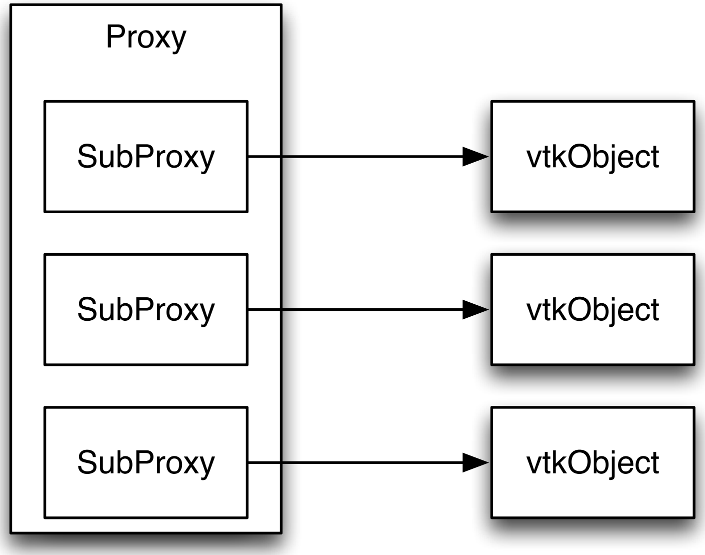
Proxies at implemented in C++ classes (specifically vtkSMProxy). Many subclasses exist to refine behavior.

vtkObject C++ inheritance

The objects that proxies control also have C++ inheritence.

SubProxies

Proxies can contain SubProxies. The parent Proxy can share properties with its Subproxies, and thus one Proxy can control many vtkObjects.



Proxy configuration inheritance

Proxies are configured from the contents of XML files (Servers/ServerManager/rendering.xml).

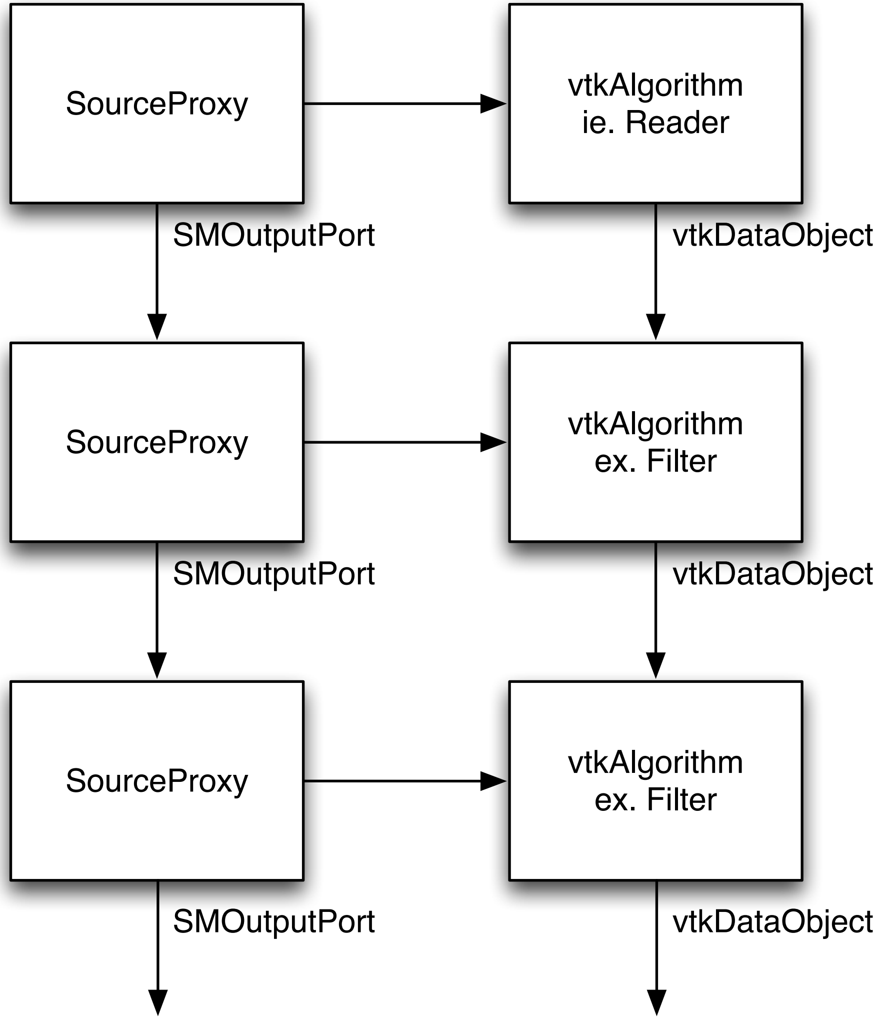
The proxy name from the XML defines the specific C++ vtkSMProxy subclass that is instantiated when a given proxy is asked for.

The XML configurations have an inheritance relationship that is independent of the C++ class inheritance.

Configurations also can define containment relationships (SubProxies).

Run time configuration

The C++ and XML configuration determine what overall static structure of a proxy is, but the proxy has to be finalized at run time. Here, internal pipelines are constructed by calling mainly vtkSMProxy::BeginCreateVTKObjects and then vtkSMProxy::CreatePipeline()

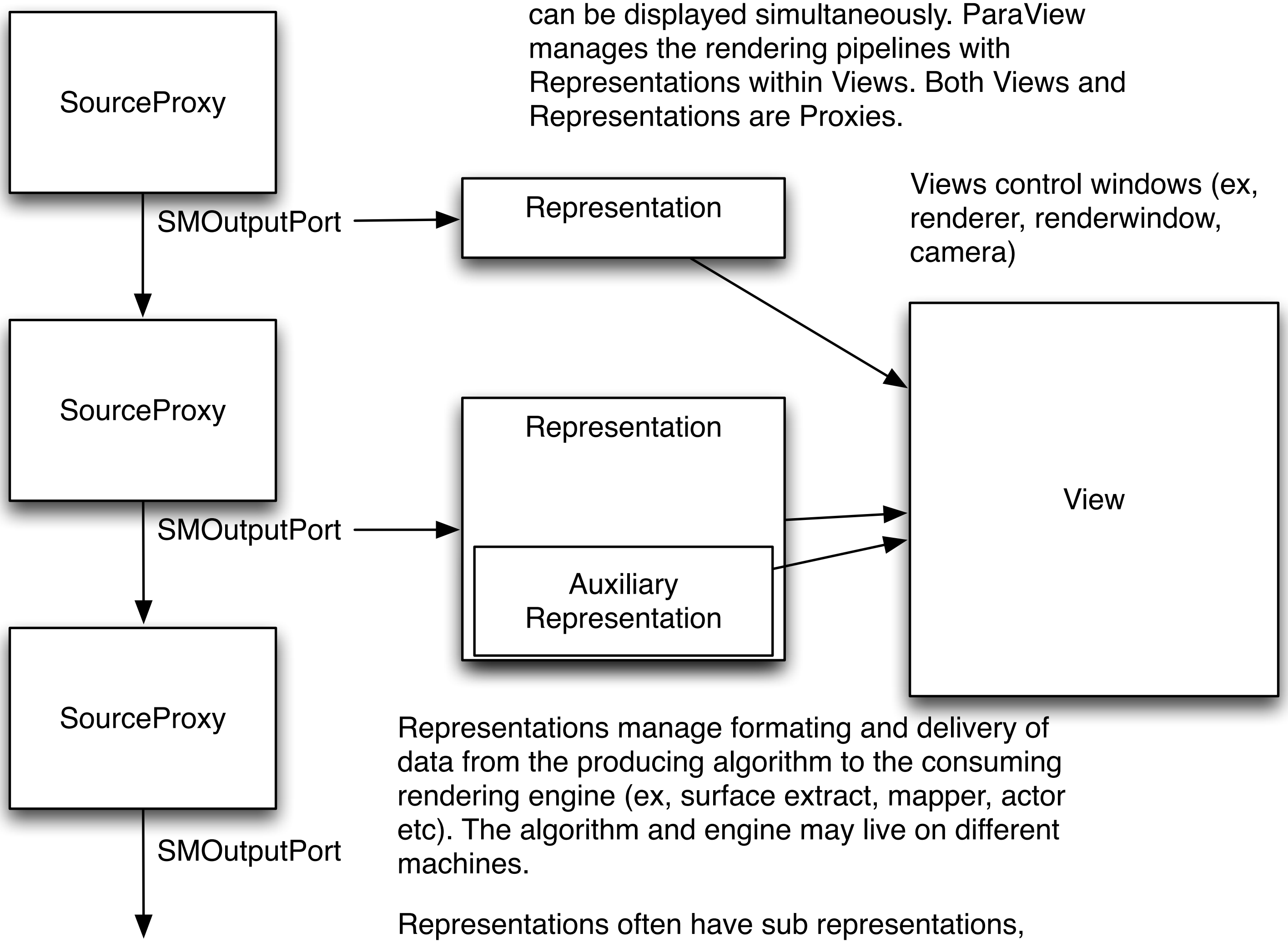


ParaView sets up data processing pipeline by instantiating SourceProxies. vtkSMSourceProxies are vtkSMProxies that are specialized to control vtkAlgorithms.

Connections between SourceProxies are managed with SMOutputPort proxies. These correlate to vtkAlgorithm::OutputPorts, each of which produces vtkDataObjects.

The SourceProxy pipeline graph mirrors the Algorithm pipeline graph, but it is not 1:1 because Proxies (via SubProxies) can control more than one Algorithm. This happens for example in a Clip filter which controls the a widget and the filter that clips onto the widget.

Every vtkDataObject produced along the pipeline can be displayed simultaneously. ParaView manages the rendering pipelines with Representations within Views. Both Views and Representations are Proxies.



SourceProxy

SMOutputPort

Representation

SourceProxy

SMOutputPort

Representation

Auxiliary Representation

View

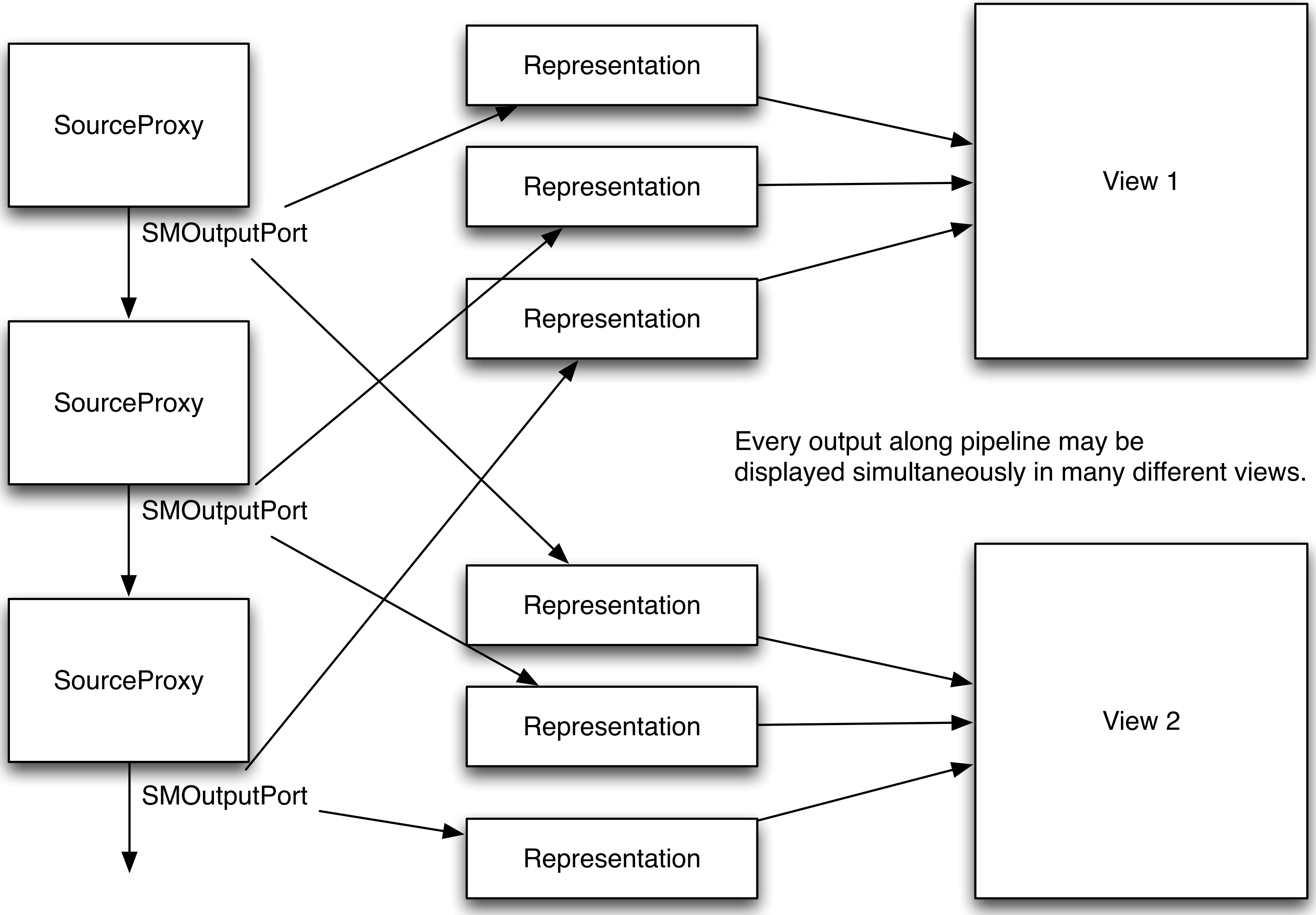
SourceProxy

SMOutputPort

Views control windows (ex, renderer, renderwindow, camera)

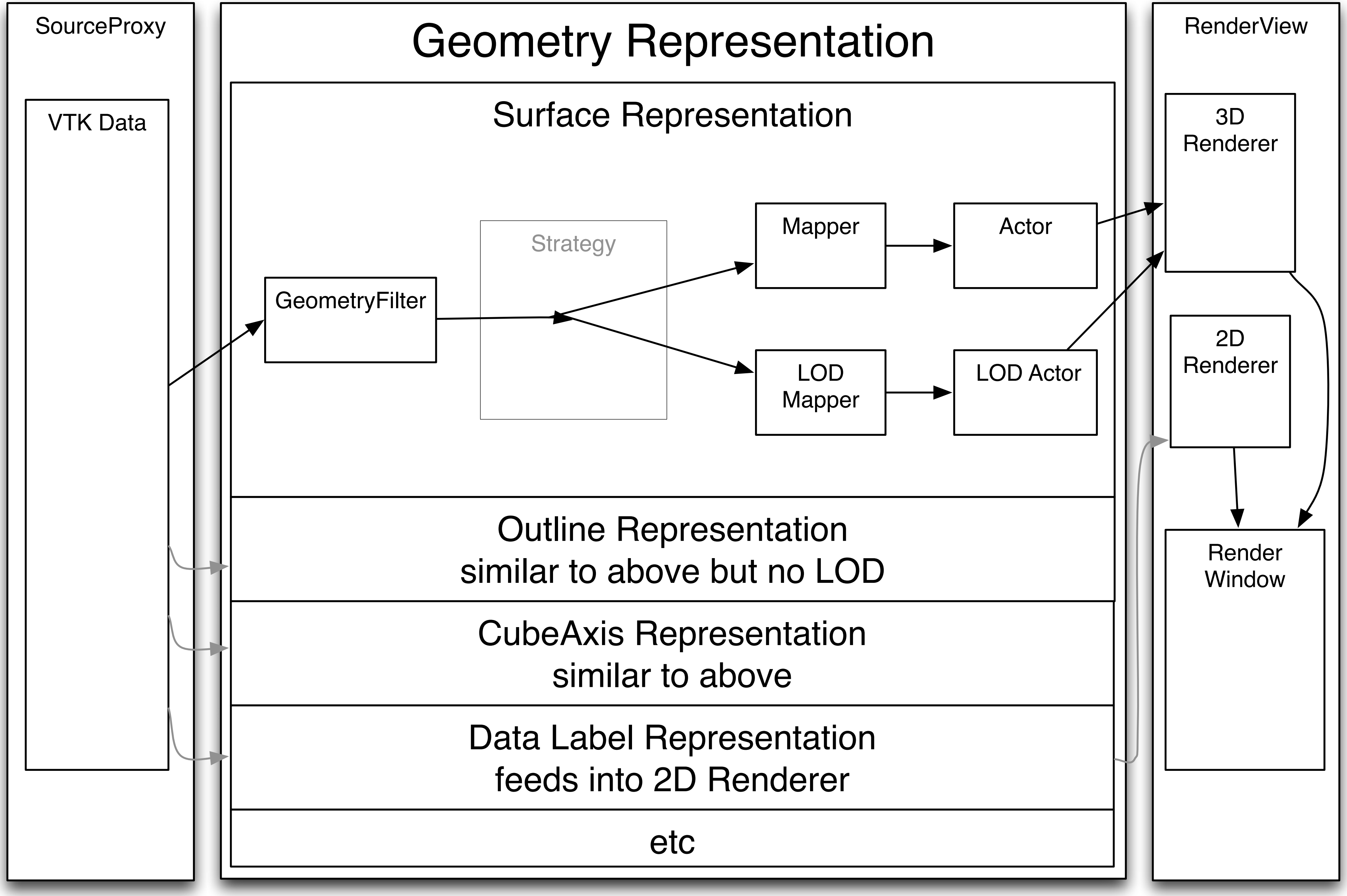
Representations manage formating and delivery of data from the producing algorithm to the consuming rendering engine (ex, surface extract, mapper, actor etc). The algorithm and engine may live on different machines.

Representations often have sub representations, these can be swapped in and out (surface mode verse wireframe mode), or any number of them can be enabled simultaneously (surface mode and selection labelling.)

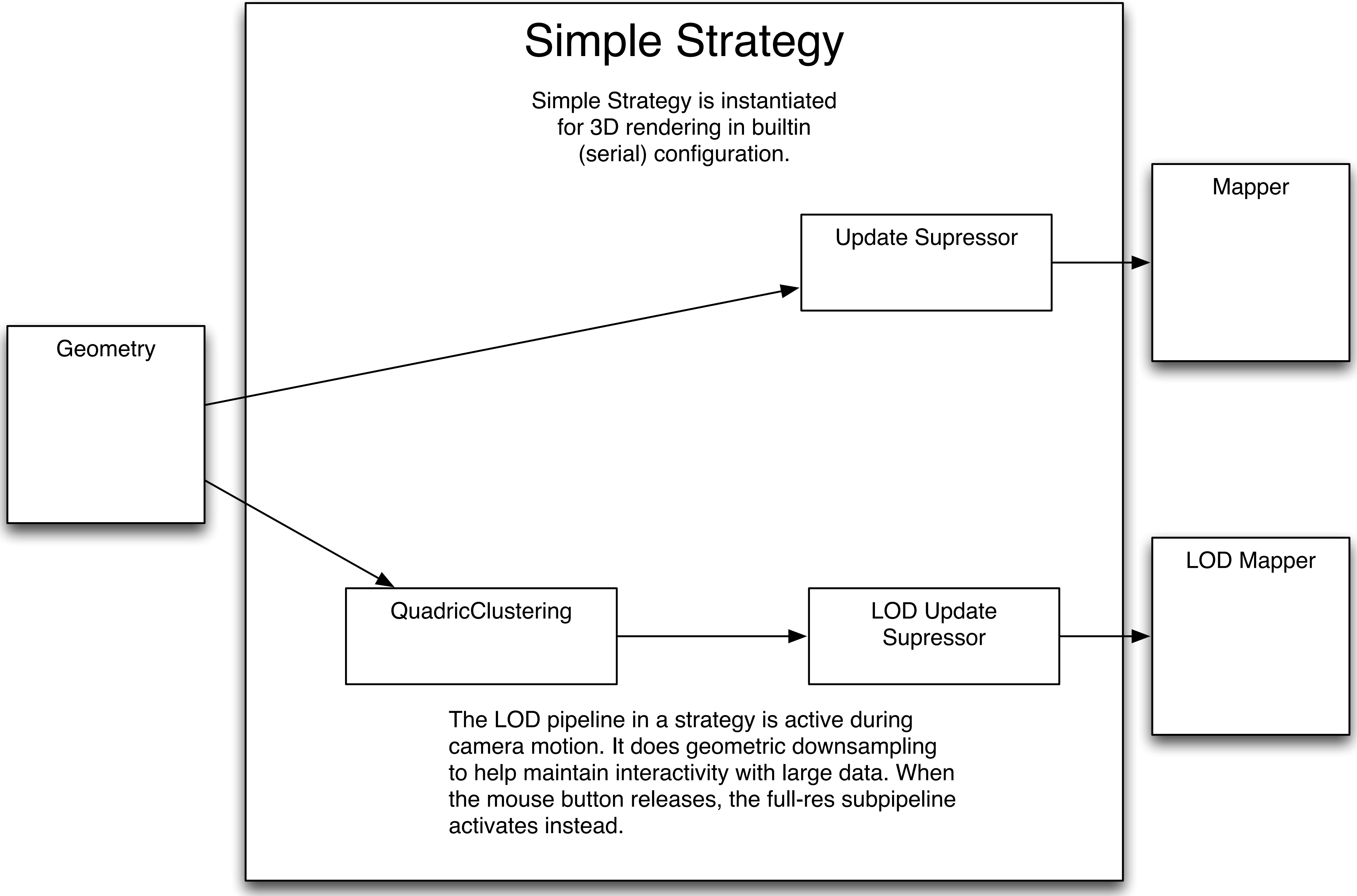


Every output along pipeline may be
displayed simultaneously in many different views.

Exact representation chosen depends on data type and view type.
Ex, Spreadsheet view doesn't have mappers and actors in the representation,
nor cameras and lights in the View.



Representations have internal Strategy proxies. Strategies give the display pipeline configuration independence. The Strategy chosen depends on data type and configuration.



Simple Strategy

Simple Strategy is instantiated
for 3D rendering in builtin
(serial) configuration.

Geometry

Update Supressor

Mapper

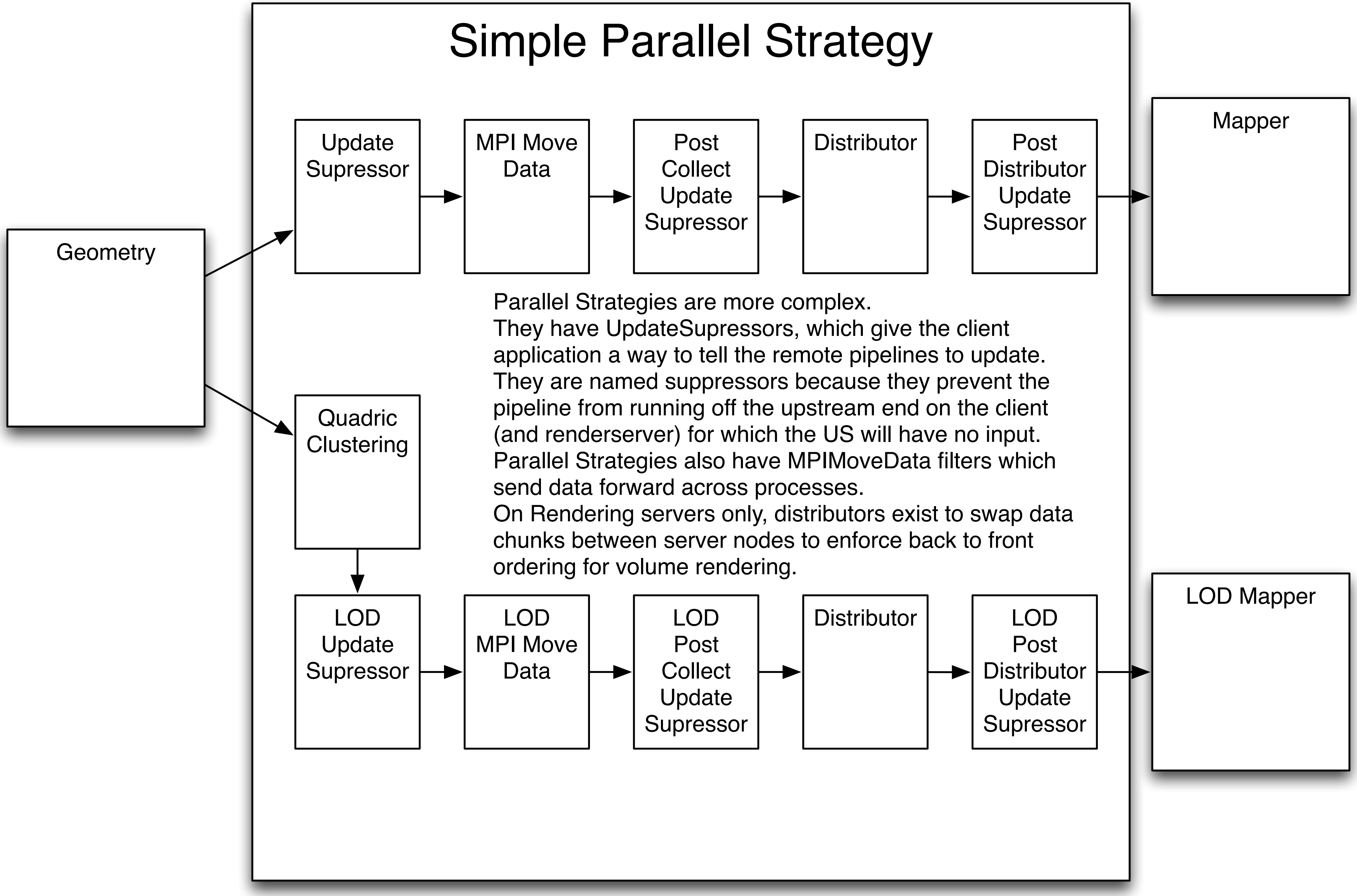
QuadricClustering

LOD Update
Supressor

LOD Mapper

The LOD pipeline in a strategy is active during camera motion. It does geometric downsampling to help maintain interactivity with large data. When the mouse button releases, the full-res subpipeline activates instead.

Simple Parallel Strategy



Geometry

Update Supressor

MPI Move Data

Post Collect Update Supressor

Distributor

Post Distributor Update Supressor

Mapper

Quadric Clustering

LOD Update Supressor

LOD MPI Move Data

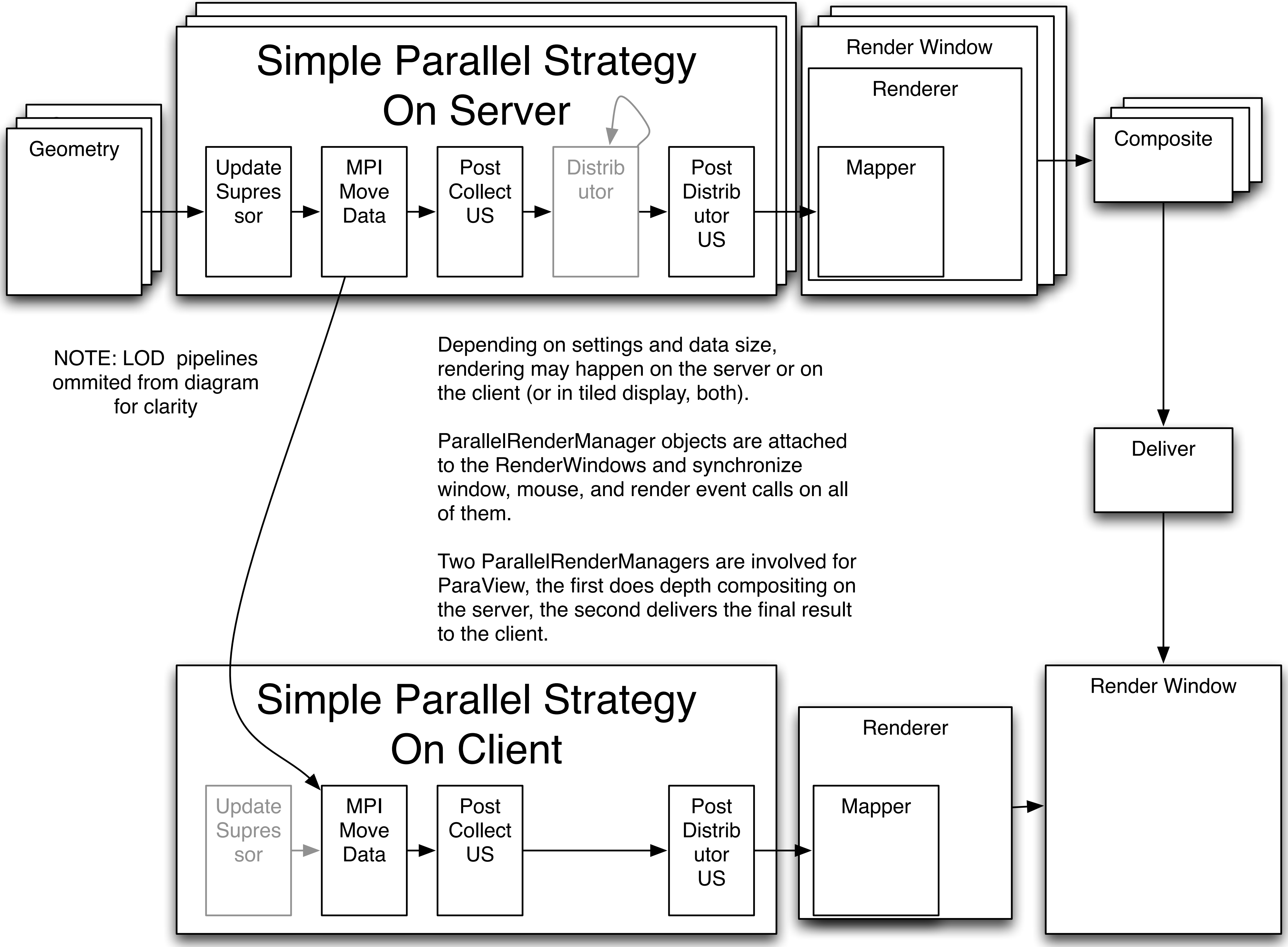
LOD Post Collect Update Supressor

Distributor

LOD Post Distributor Update Supressor

LOD Mapper

Parallel Strategies are more complex.
They have UpdateSupressors, which give the client application a way to tell the remote pipelines to update.
They are named suppressors because they prevent the pipeline from running off the upstream end on the client (and renderserver) for which the US will have no input.
Parallel Strategies also have MPIMoveData filters which send data forward across processes.
On Rendering servers only, distributors exist to swap data chunks between server nodes to enforce back to front ordering for volume rendering.

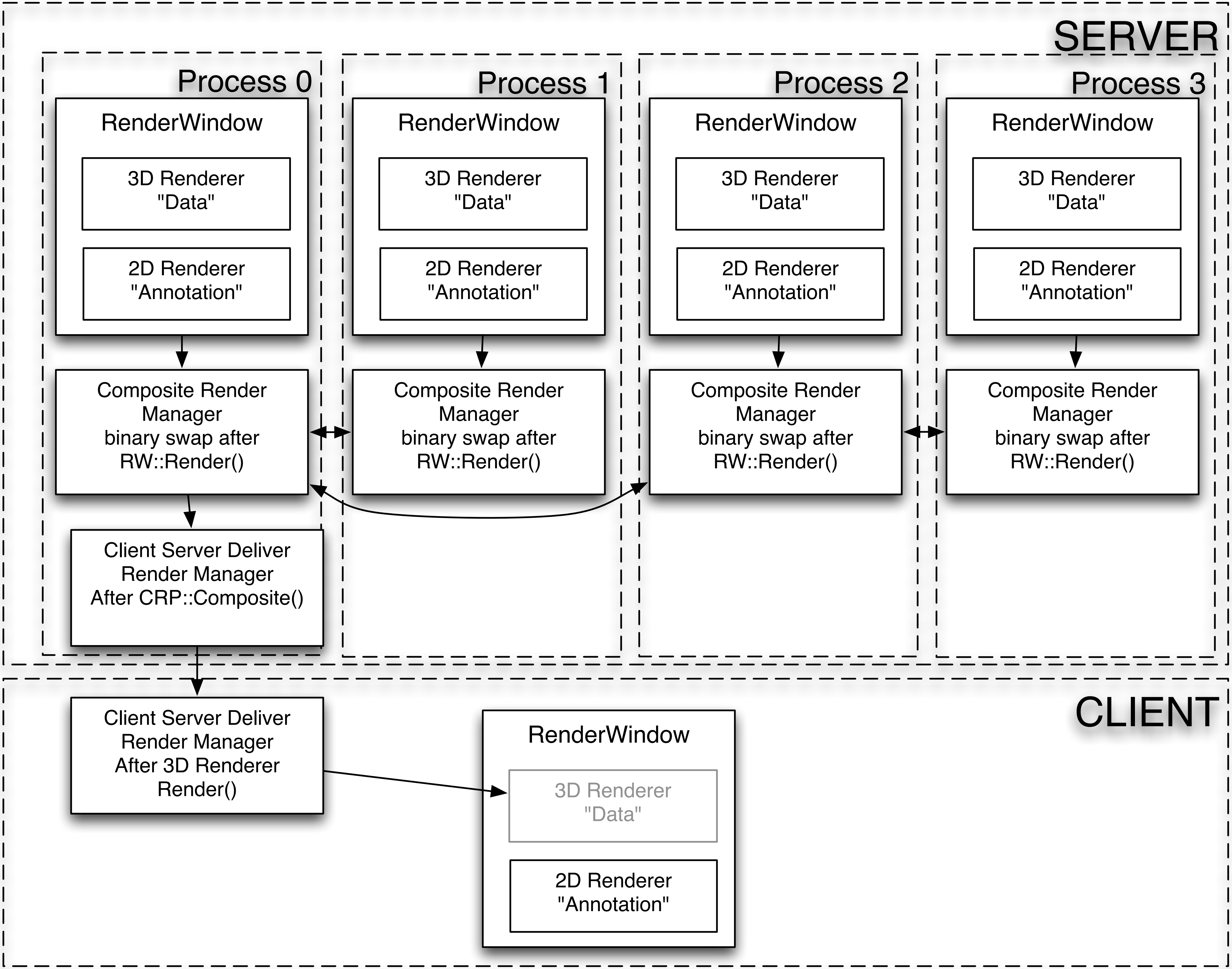


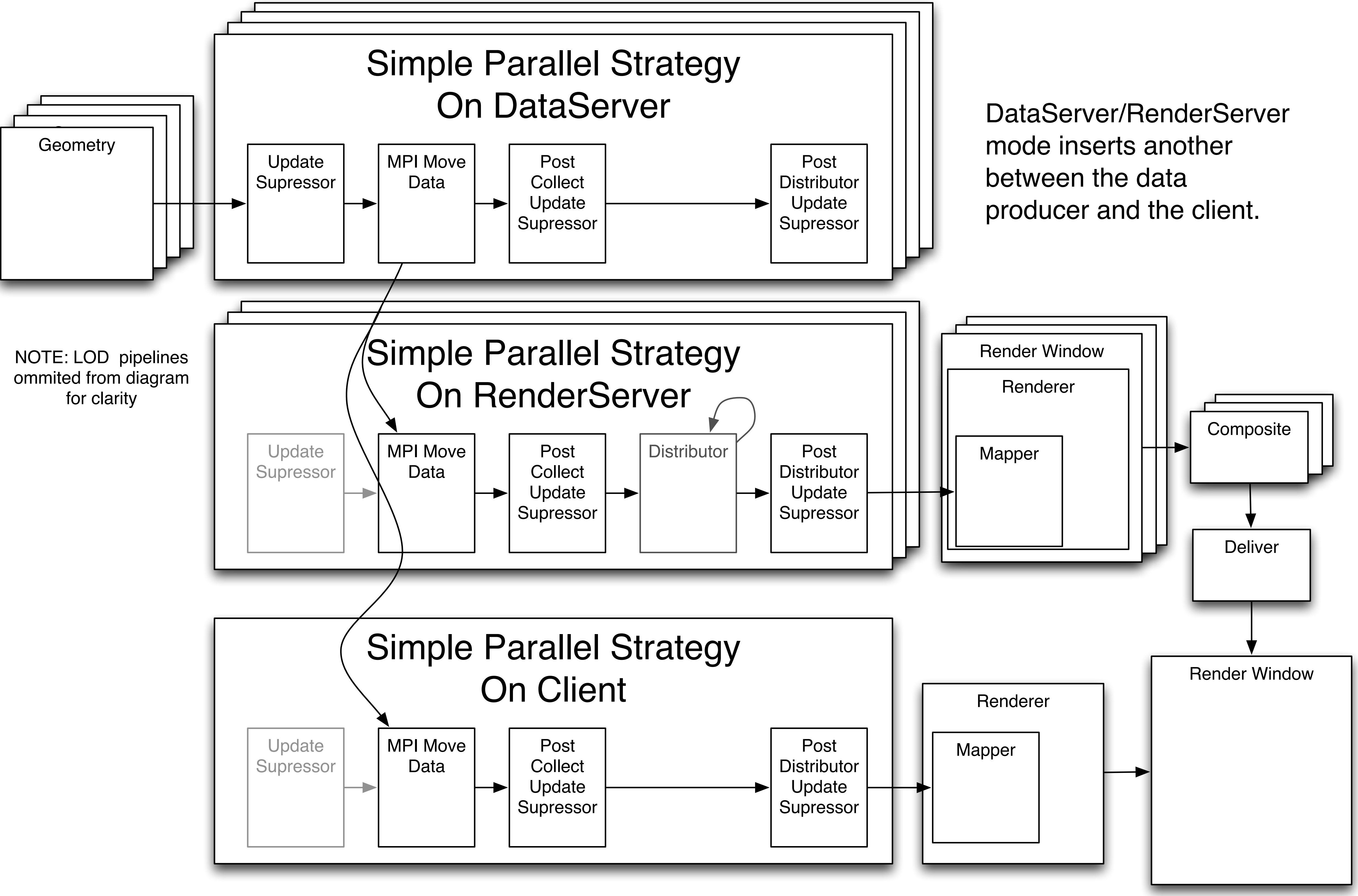
NOTE: LOD pipelines ommited from diagram for clarity

Depending on settings and data size, rendering may happen on the server or on the client (or in tiled display, both).

ParallelRenderManager objects are attached to the RenderWindows and synchronize window, mouse, and render event calls on all of them.

Two ParallelRenderManagers are involved for ParaView, the first does depth compositing on the server, the second delivers the final result to the client.


SERVER
Process 0
Process 1
Process 2
Process 3
RenderWindow
3D Renderer "Data"
2D Renderer "Annotation"
RenderWindow
3D Renderer "Data"
2D Renderer "Annotation"
RenderWindow
3D Renderer "Data"
2D Renderer "Annotation"
RenderWindow
3D Renderer "Data"
2D Renderer "Annotation"
Composite Render Manager binary swap after RW::Render()
Composite Render Manager binary swap after RW::Render()
Composite Render Manager binary swap after RW::Render()
Composite Render Manager binary swap after RW::Render()
Client Server Deliver Render Manager After CRP::Composite()
CLIENT
Client Server Deliver Render Manager After 3D Renderer Render()
RenderWindow
3D Renderer "Data"
2D Renderer "Annotation"


Geometry
Simple Parallel Strategy On DataServer
Update Supressor
MPI Move Data
Post Collect Update Supressor
Post Distributor Update Supressor
Simple Parallel Strategy On RenderServer
Update Supressor
MPI Move Data
Post Collect Update Supressor
Distributor
Post Distributor Update Supressor
Render Window
Renderer
Mapper
Composite
Deliver
Simple Parallel Strategy On Client
Update Supressor
MPI Move Data
Post Collect Update Supressor
Post Distributor Update Supressor
Renderer
Mapper
Render Window

DataServer/RenderServer mode inserts another between the data producer and the client.

NOTE: LOD pipelines ommited from diagram for clarity