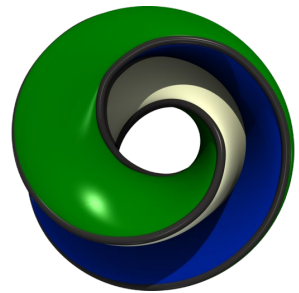


# VIS 2019

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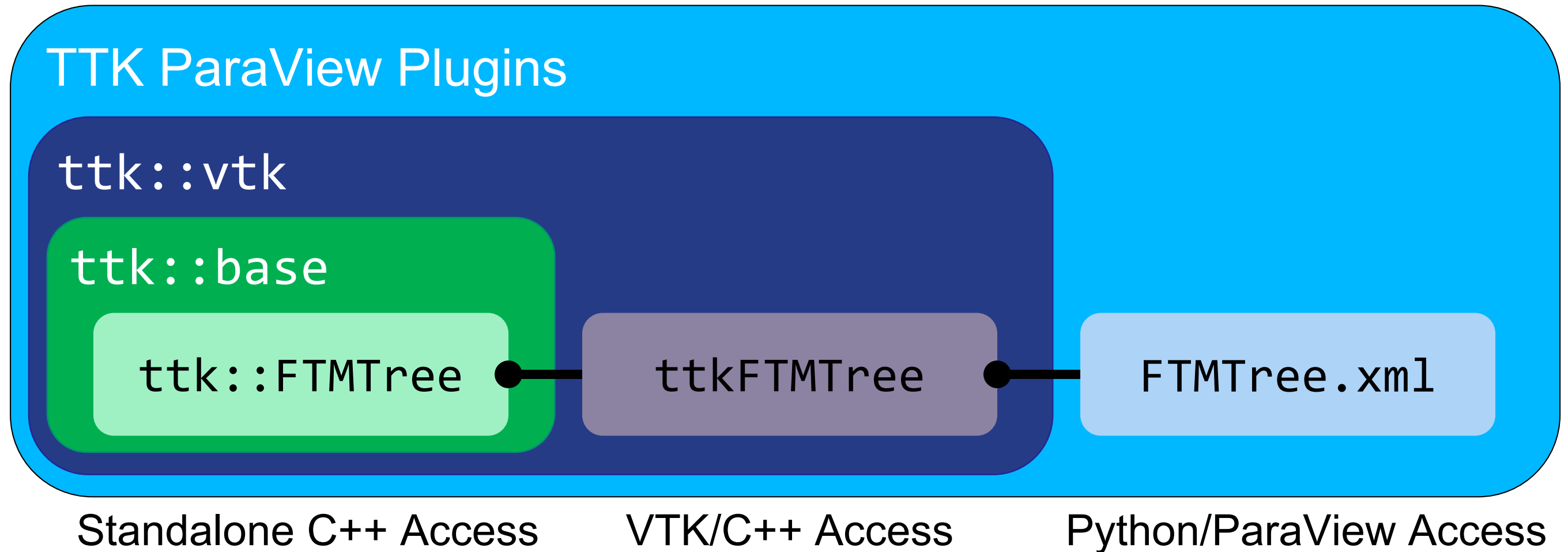


## TTK's architecture and core data structures

Will Usher, SCI Institute, University of Utah



# TTK Architecture Overview



# ttk::base – Base TDA Functors

- All TTK algorithms implemented as template functors
- Provides the `ttk::Triangulation` data-structure for TDA algorithms
  - Efficient mesh traversal routines for explicit or implicit meshes

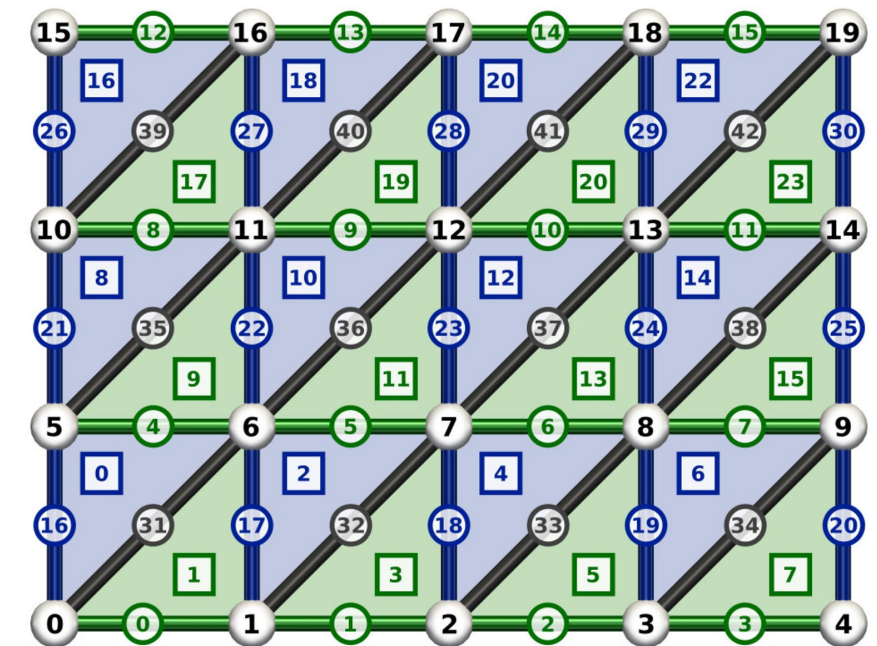
`ttk::base`

`ttk::FTMTree`

Standalone C++ Access

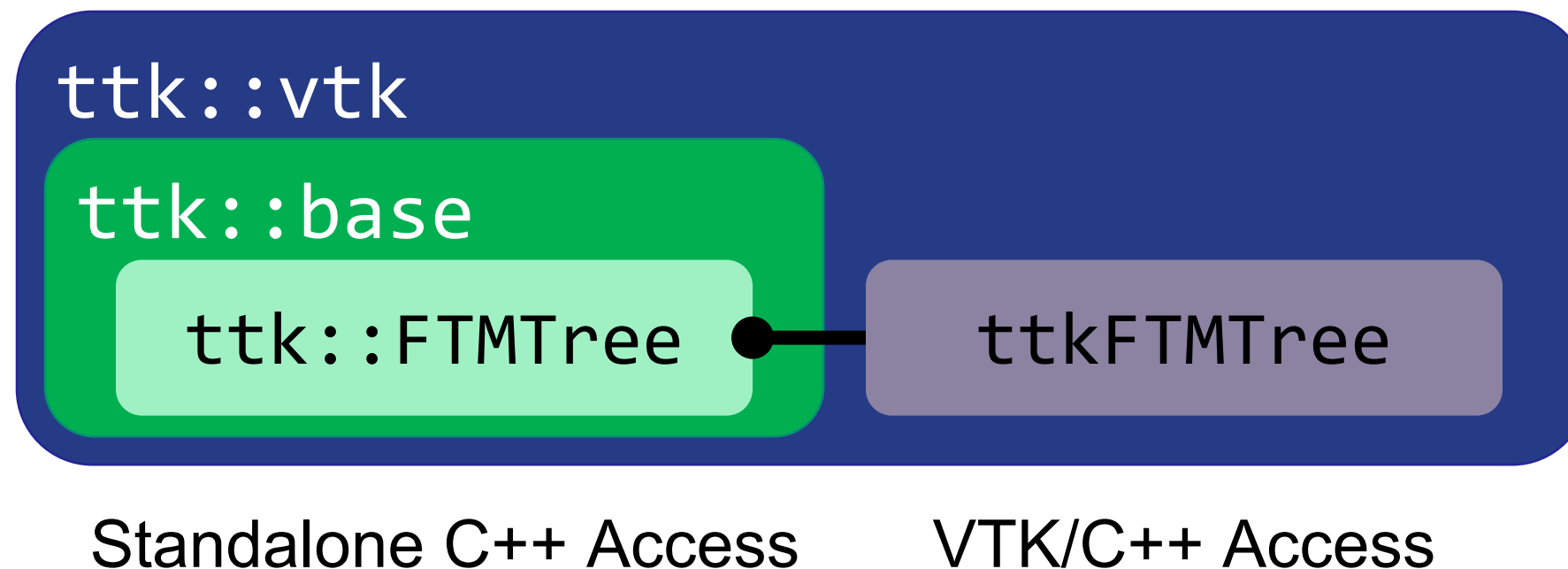
# ttk::base – Cached Triangulation Data Structure

- `ttk::Triangulation` – optimized mesh traversal typically used in TDA
  - Fast boundary, skeleton, link and face/co-face traversals
  - Supports explicit meshes and implicit meshes (grid data)
- Run pre-processing once up front for traversal needs
  - E.g., `preprocessVertexEdges()`, `preprocessCellEdges()`



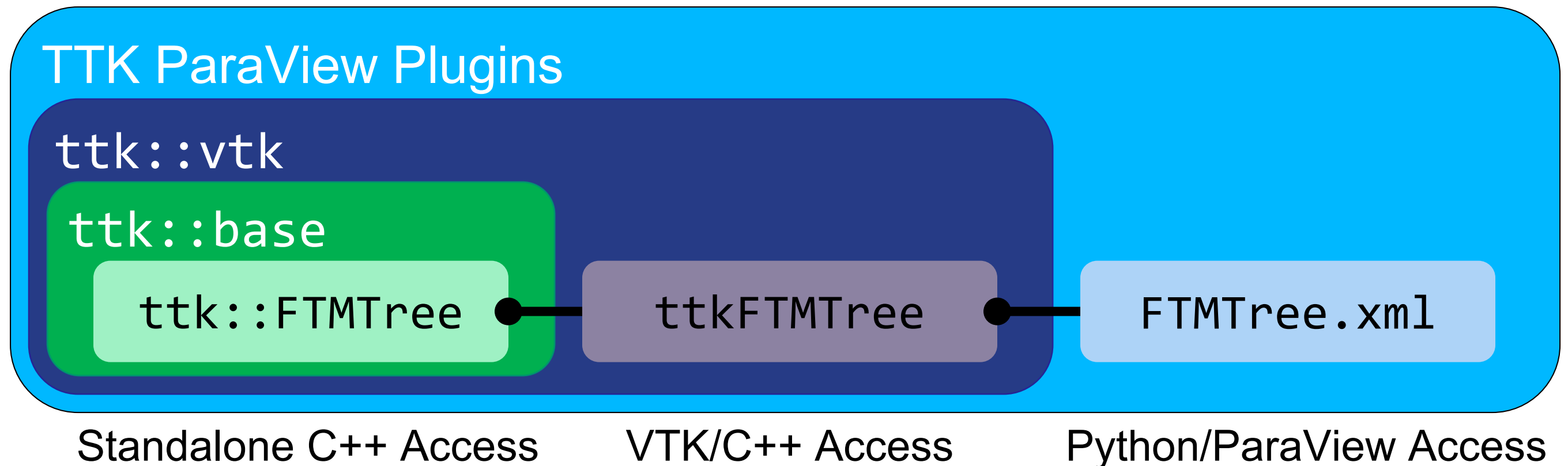
# ttk::vtk – VTK Wrappers

- TTK base functors wrapped into vtkDataSetAlgorithm filters
- Take VTK inputs/outputs, grab raw pointers and pass to functors



# TTK ParaView Plugins

- Integrate VTK wrappers as filters available in ParaView & pvpython
- Requires plugin XML description and the VTK wrapper



# Using TTK through the VTK Wrappers

- Recommended path for developers writing standalone applications
- CMake package files provided for TTK base and TTK VTK
- Automatically searches for TTK Base and VTK

```
find_package(TTKVTK REQUIRED)
```

# Linking TTK through the VTK Wrappers

- Link everything, or just what you need
- See examples in TTK repo and [github.com/Twinklebear/topo-vol/](https://github.com/Twinklebear/topo-vol/)

```
target_link_libraries(app PUBLIC ttk::vtk::ttkAll  
                      ...)
```

```
target_link_libraries(app2 PUBLIC  
                      ttk::vtk::ttkFTMTree  
                      ttk::vtk::ttkPersistenceCurve  
                      ...)
```



# Extending TTK

- Implement your core algorithms as template functors in `ttk::base`
  - In CMake: `ttk_add_base_library`
- Provide a VTK wrapper to pass VTK data to/from your functor
  - In CMake: `ttk_add_vtk_library`
- Provide a ParaView plugin XML file for your VTK wrapper
  - In CMake: `ttk_add_paraview_plugin`
- See sample module “Blank”, or use the provided scripts

# Thanks!