There is wide variability and opportunity with using CTS to help characterize the operating characteristics of complex trial designs including adaptive designs. What would be the ideal software platform for conducting these simulations? Any simulations will involve high-performance computing where more is better with regards to pure computational power. Julia is a full-featured, high-level, functional orientated programming language designed for high-performance computing (HPC). Julia syntax enables one to write statements that read like a math algorithm. Because Julia is intuitive, it facilitates faster learning and faster development time for your programming solutions. In this paper, the Julia Working Group will provide a case examples of the capabilities of Julia Programming within the context of high-performance computing and complex simulations. These examples will illustrate the speed and power of Julia which give capabilities needed to rapidly drive CTS within the time constraints of study protocol development.

1. What does it mean to conduct a clinical trial simulation
2. Need to generate data (nuisance parameters, protocol violations, missing data, variables you can adjust and change)
3. Run through intended analysis scenarios (thousands of scenarios)
4. Crunch/get empirical result/performance control/optimize

Make it obvious why Julia is the natural choice. (more is better and Julia is great!)  
Timeline constraints – develop protocol/stakeholders need answers not enough time  
Execute the methodology assumes it is well developed in Julia. Models/packages need to be assess for stat methodology. Any gaps/holes that yet to be developed.  
How to utilize Julia code without experts on your team? Can you set up to package that is able to be understood and run and be user-friendly for non-experts? Is this flexible enough to capture the design?

Some R tools are available. Melvin and Mike Carniello has looked into simulations using SAS and gave a talk in 2011/12. They reviewed what is out there and there is a new guideline. They covered where simulations and modelling may be used: enrollment, sample size estimation, create data to look at scenarios and projection, missing data, complex modeling and design. What are people doing using SAS. Bootstrapping MCMC and PK. Proc MCMC vs Julia (It a drag race!) Go Julia!!

This comparison would be very interesting! SAS Viya? How is GPU acceleration used in SAS/Julia? Cuda arrays?

Graphic about exponential growth in the use of Julia and packages.  
  
1) Chris get the whitepaper template (point is to share enthusiasm for the Julia language not a how-to on simulations)

2) Chris/Patrick/Jeff create a high-level outline and assign sections

3) Chris/Patrick/Jeff create the Connect paper outline – after the PHUSE Paper Review Meeting.

4) Chris/Patrick get with SAS to see what they have to offer.

5) Could possibly have a Julia workshop at the Connect with vscode, Julia, Jupyter and getting an example program to run. See Juliacon YouTube presentation on vscode.