EPRI | ELECTRIC POWER RESEARCH INSTITUTE

OpenDSS Training Workshop

Basics and Scripting

Roger C. Dugan
EPRI Knoxville, TN

August 24, 2020

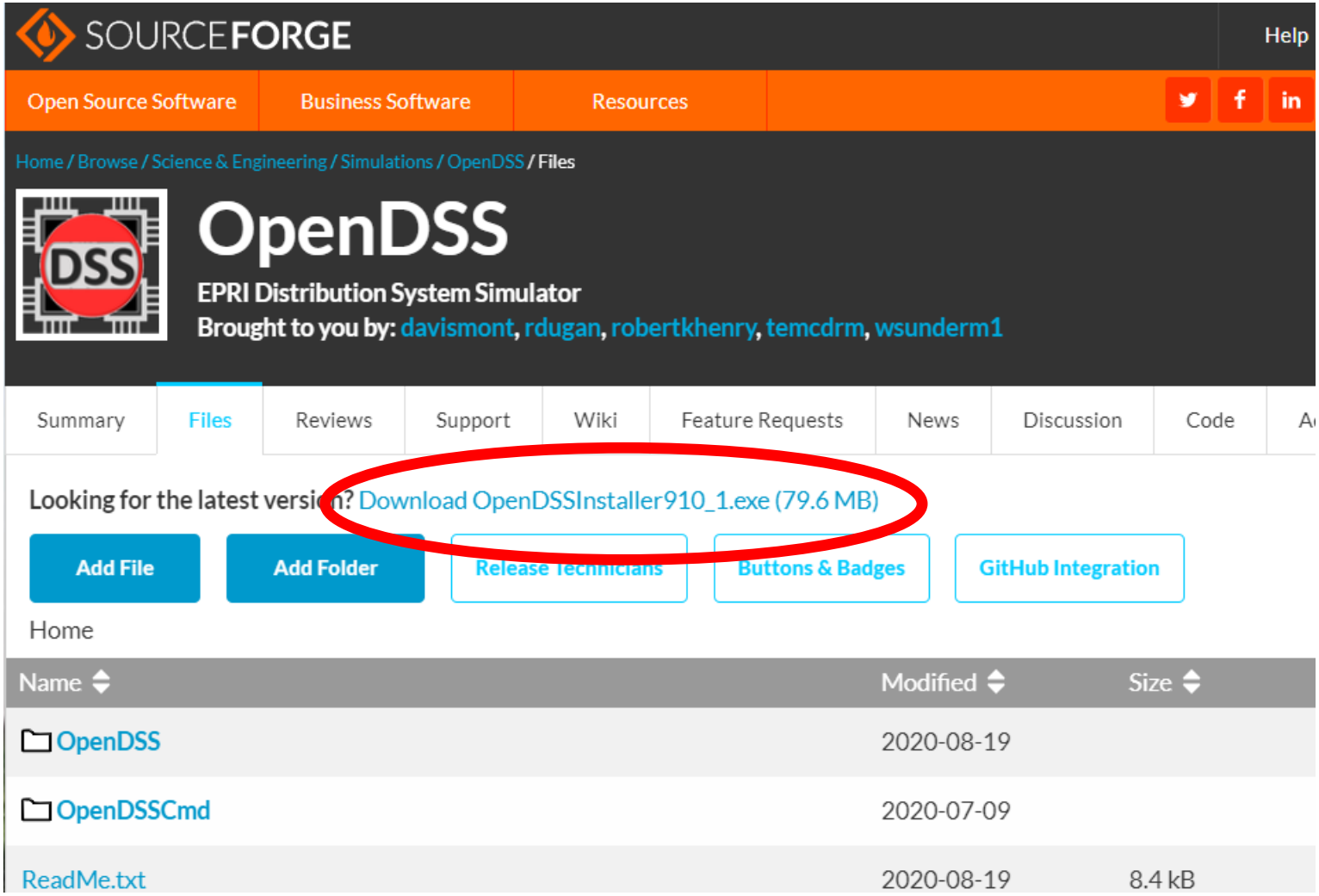
Instructor

- **Roger C. Dugan, *Life Fellow, IEEE***
- **Roger is a Sr. Technical Executive with EPRI in Knoxville, Tennessee USA. He has over 45 years of combined experience in distribution engineering with EPRI, Electrotek Concepts, and Cooper Power Systems. He holds the BSEE degree from Ohio University and the Master of Engineering in Electric Power Engineering degree from Rensselaer Polytechnic Institute, Troy, NY. Roger has worked on many diverse aspects of power engineering over his career because of his interests in applying computer methods to power system simulation. Beginning with a student internship with Columbus and Southern Ohio Electric Co, his work has been focused on Distribution Engineering. He was elected a Fellow of the IEEE for his contributions in harmonics and transients analysis. Recently, he has been very active in distributed generation, particularly as it applies to utility distribution systems and distribution system analysis. He was the 2005 recipient of the IEEE Excellence in Distribution Engineering Award. He is coauthor of Electrical Power Systems Quality published by McGraw-Hill, now in its 3rd edition. He serves on the IEEE PES Distribution System Analysis Subcommittee and is active in the Distribution Test Feeders WG.**

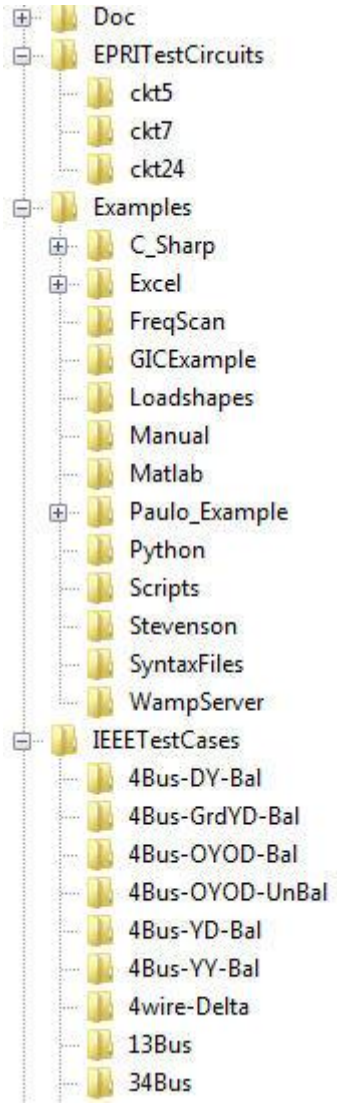
Installation, Startup, and Basic Usage

Program Installation

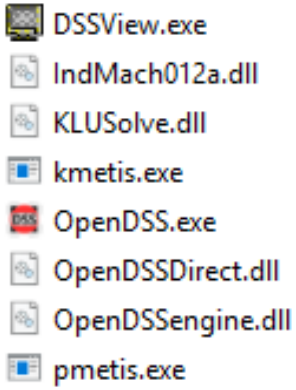
Download the Installer Files



OpenDSS Files Installed

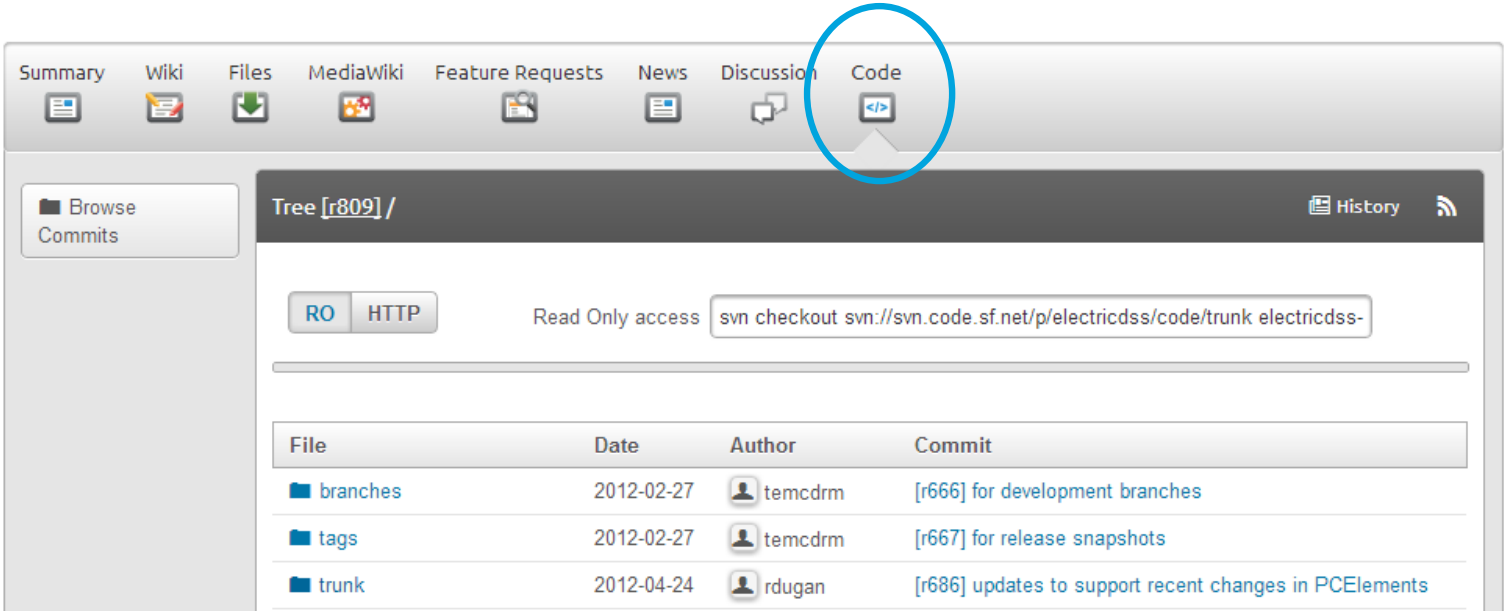


Main Program Files

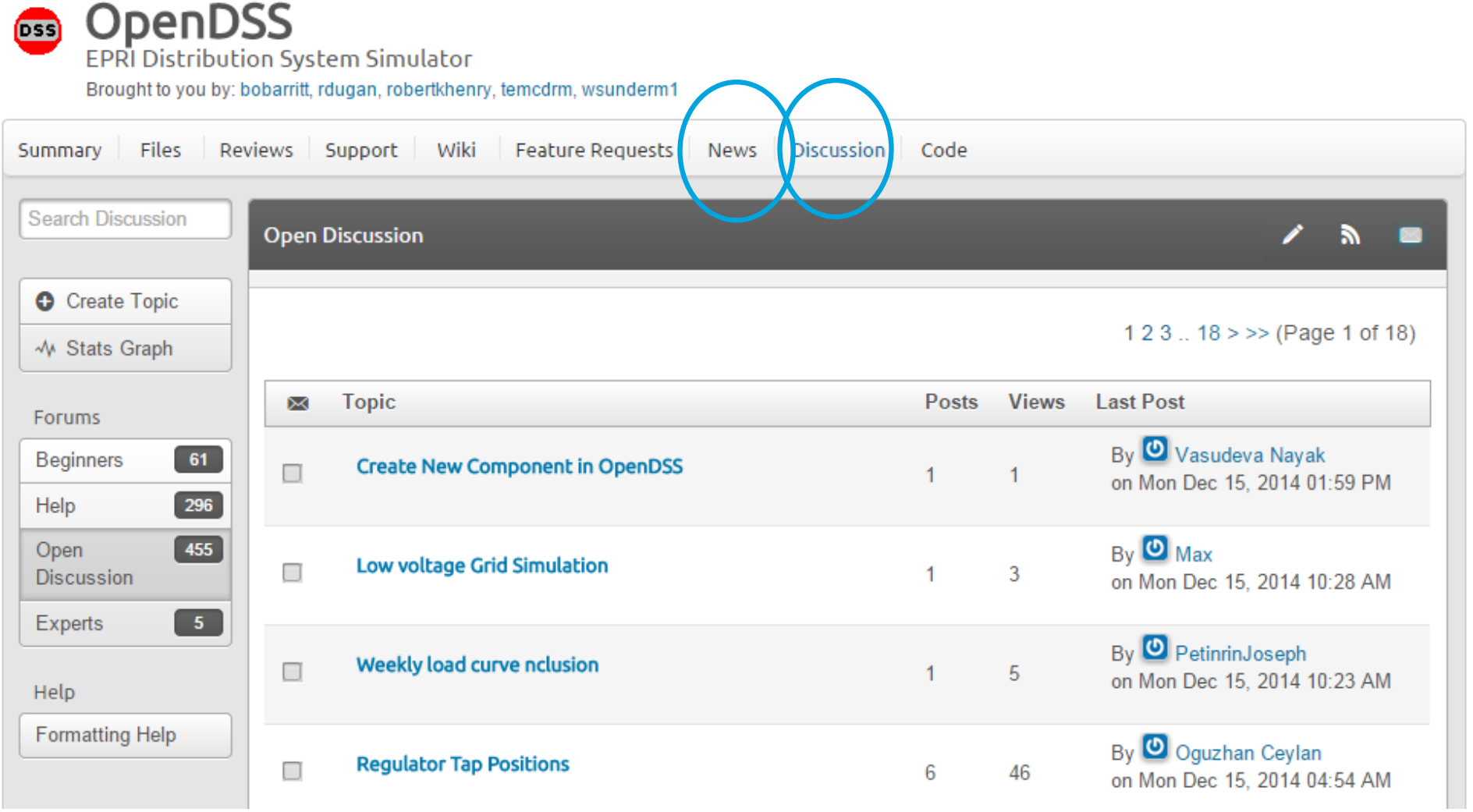


SourceForge.Net Links for OpenDSS

- EPRI Links Page
  - https://www.epri.com/#/pages/sa/opendss?lang=en-US
- OpenDSS Download Files:
  - http://sourceforge.net/projects/electricdss/files/
- Top level of Main Repository

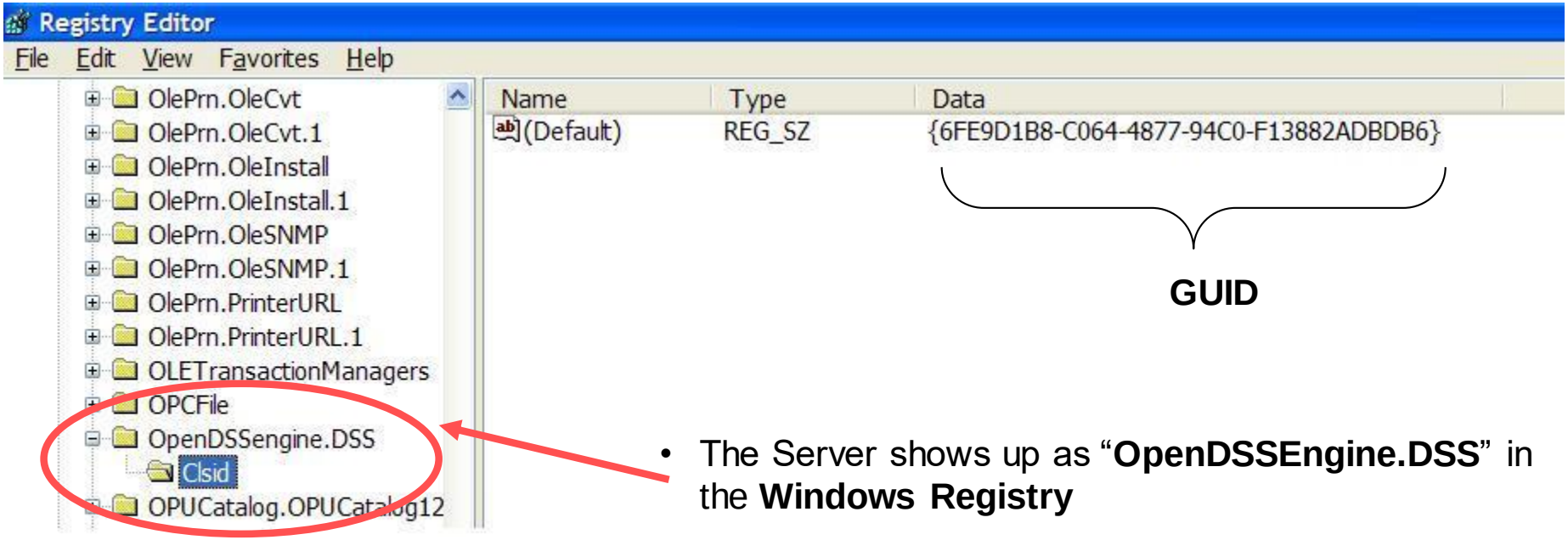


Discussion Forum & News for OpenDSS



COM Server Registration

Windows Registry Entry

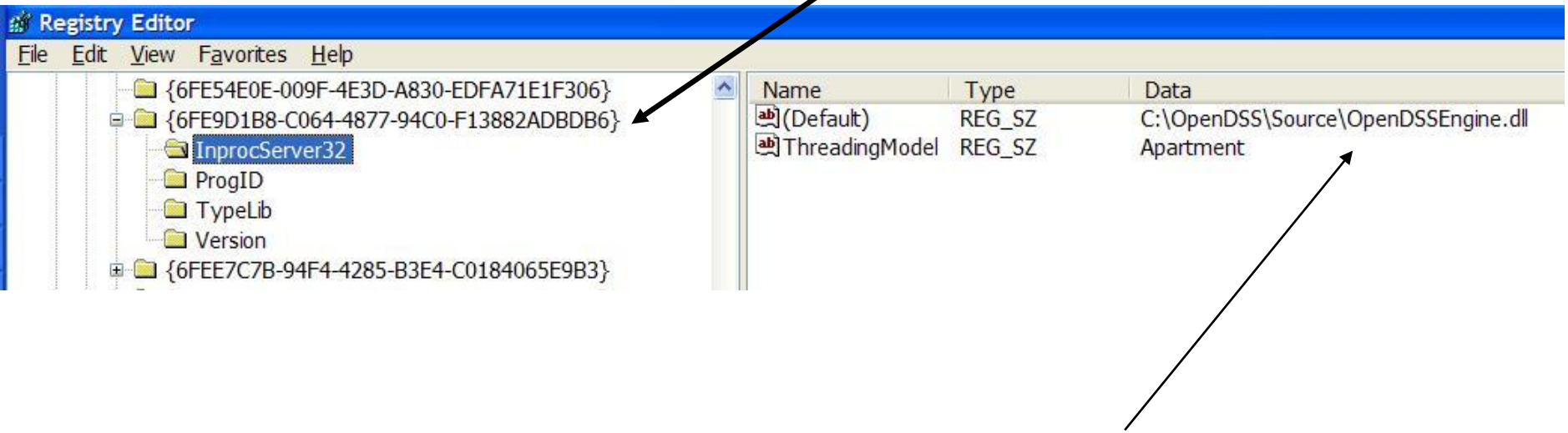


- The Server shows up as "**OpenDSSEngine.DSS**" in the **Windows Registry**

The OpenDSS is now available to any program on the computer

The GUID References the DLL File ….

If you look up the GUID in RegEdit



Points to OpenDSSEngine.DLL
(In-process server, Apartment Threading model)

Accessing the SourceForge.Net Source Code Repository with TortoiseSVN

- Install a TortoiseSVN client from Tortoisesvn.net/downloads.
- Recommendation:

Then, to grab the files from SourceForge by:

1 - create a clean directory such as "c:\opendss"

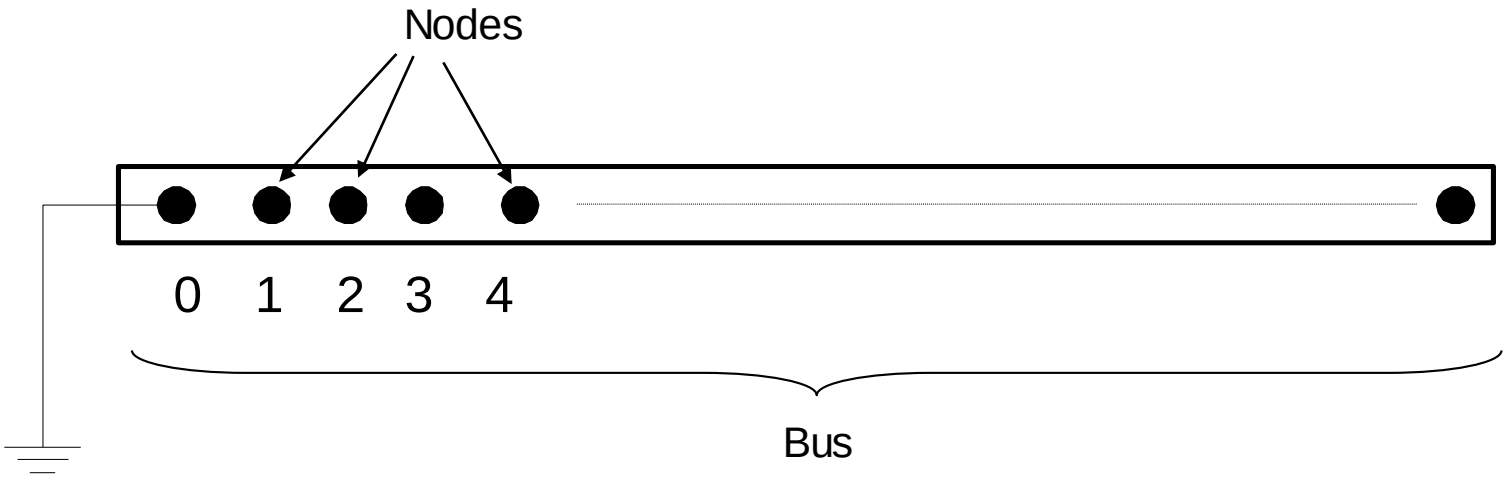
2 - **right-click** on it and choose "SVN Checkout..." from the menu

3 - the repository URL is
http://electricdss.svn.sourceforge.net/svnroot/electricdss

(Change the checkout directory if it points somewhere other than what you want.)

Thereafter, to update a folder or file, right-click on the folder or file and select **SVN Update**

DSS Bus Model (Bus ≠ Node)



Referring to Buses and Nodes (A Bus has 1 or more Nodes)

Bus1=*BusName.1.2.3.0*

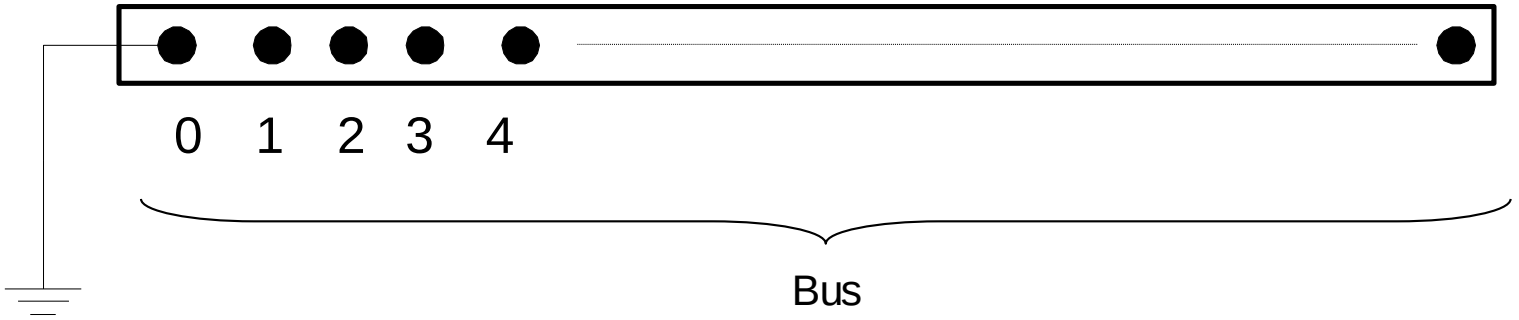
(This is the default for a 3-phase circuit element)

Shorthand notation for taking the default:

Bus1=*BusName*

Note: Sometimes this can bite you (e.g. – Transformers, or capacitors with ungrounded neutrals)

Node Numbers



The voltage at Node 0 = 0 (always)

The other Node numbers are arbitrary

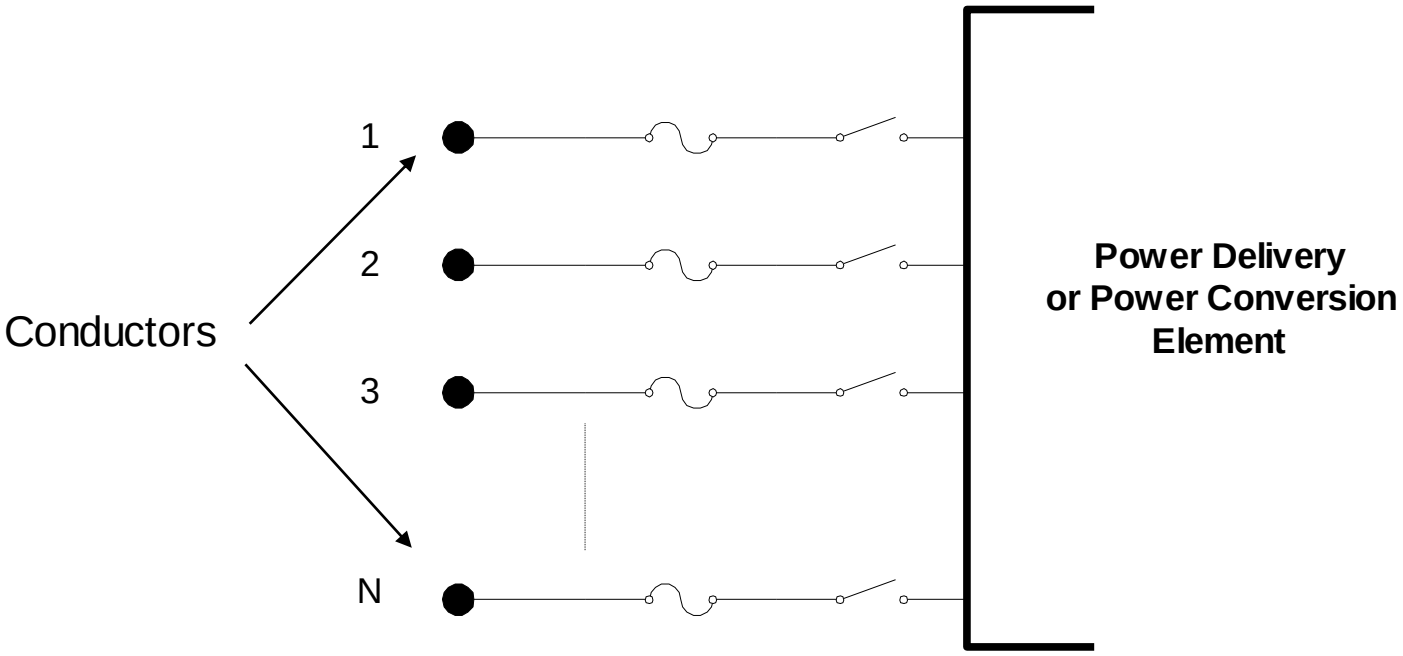
By convention, Nodes 1, 2, 3 correspond to phase ABC

- But they don't have to

You can have a very large number of nodes at a Bus

- They do not have to be pre-declared

DSS Terminal Definition

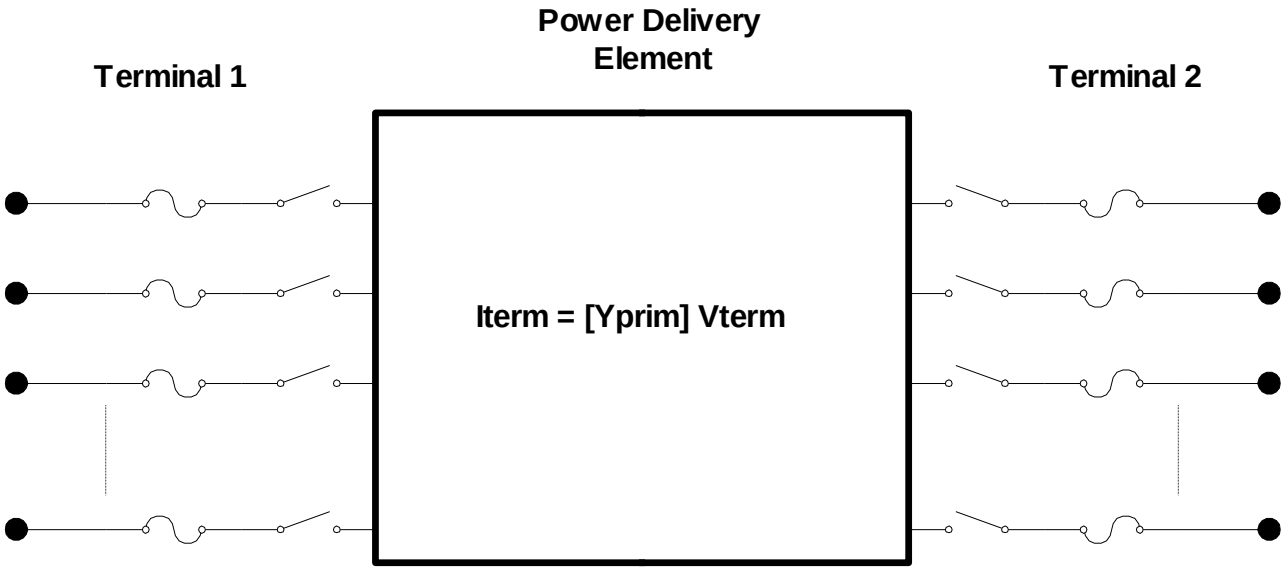


Circuit Elements have one or more *Terminals* with 1..N conductors.

Conductors connect to *Nodes* at a *Bus*

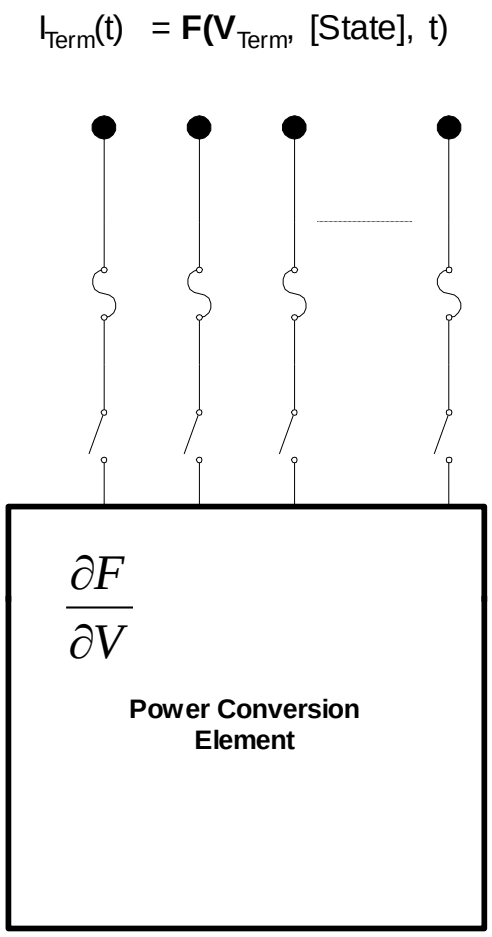
Each *Terminal* connects to one and only one *Bus*

Power Delivery Elements



PD Elements are Generally Completely Described by *[Yprim]*

Power Conversion Elements



- Power Conversion (PC) elements are typically connected in "shunt" with the Power Delivery (PD) elements
- PC Elements may be nonlinear
- Described some function of V
  - May be linear
  - e.g., Vsource, Isource
- May have more than one terminal, but typically one
  - Load, generator, storage, etc.

Command Syntax

- *Command parm1, parm2 parm3 parm 4 ….*

- Parameters may be positional or named (tagged).
- If named, an "=" sign is expected.
  - ***Name=value*** *(this is the named form)*
  - ***Value*** *(value alone in positional form)*
- *For example, the following two commands are equivalent:*
  - `New Object="Line.First Line" Bus1=b1240 Bus2=32 LineCode=336ACSR, …`
  - `New "Line.First Line", b1240 32 336ACSR, …`

Comma or white space

Delimiters

- Array or string delimiter pairs: [ ] , { },( ),“ ”,‘ ‘
- Matrix row delimiter: |
- Value delimiters: , (comma)
  any white space (tab or space)
- Class, Object, Bus, or Node delimiter: . (period)
- Keyword / value separator: =
- Continuation of previous line: ~ (More)
- Comment line: //
- In-line comment: !
- Query a property: ?

Array and Matrix Parameters

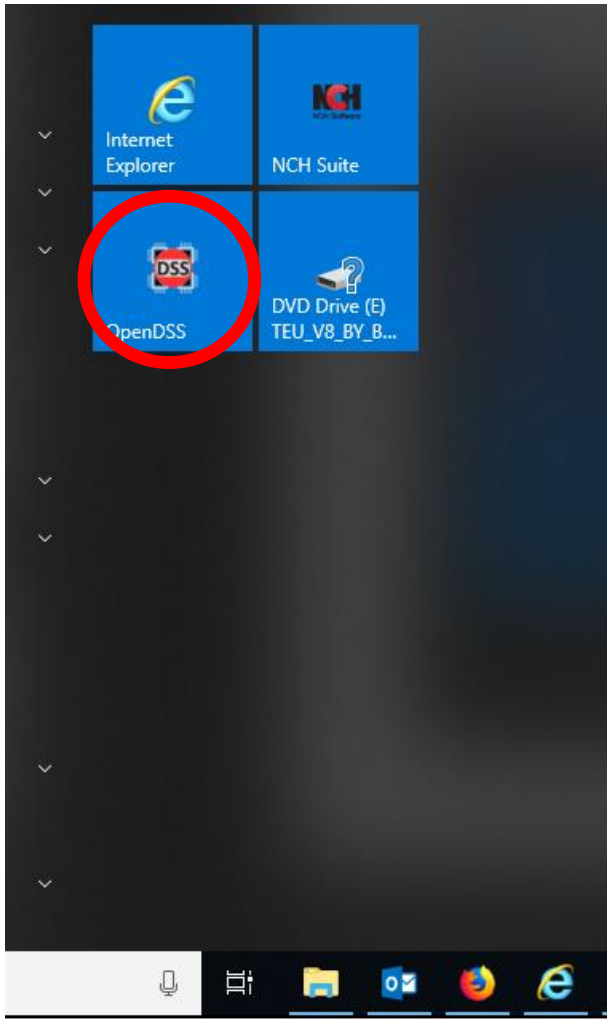
- Array
  - kvs = [115, 6.6, 22]
  - kvas=[20000 16000 16000]

- Matrix
  - *(3x3 matrix)*
    - Xmatrix=[1.2 .3 .3 | .3 1.2 3 | .3 .3 1.2]
  - *(3x3 matrix – lower triangle)*
    - Xmatrix=[1.2 | .3 1.2 | .3 .3 1.2]

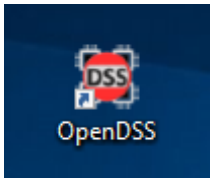
Starting the Program

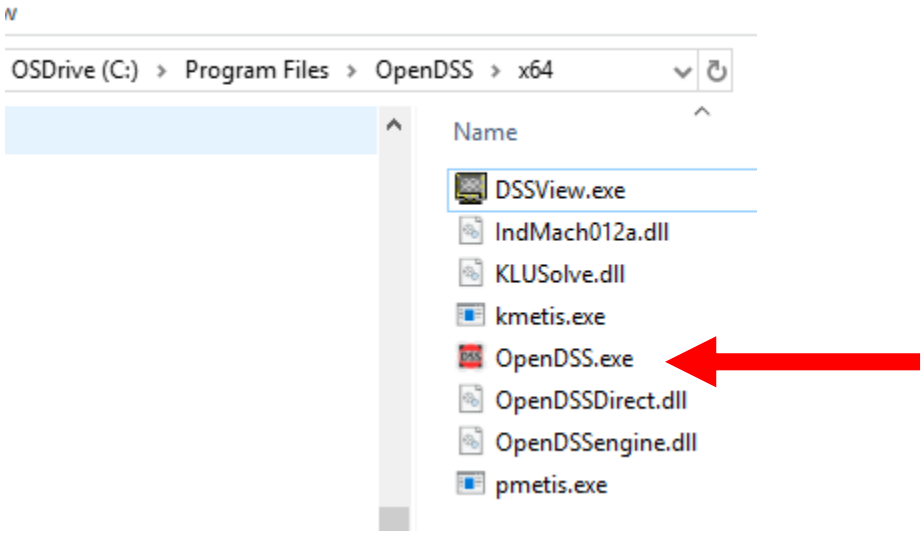
Starting OpenDSS.exe – Standalone executable

Start Menu



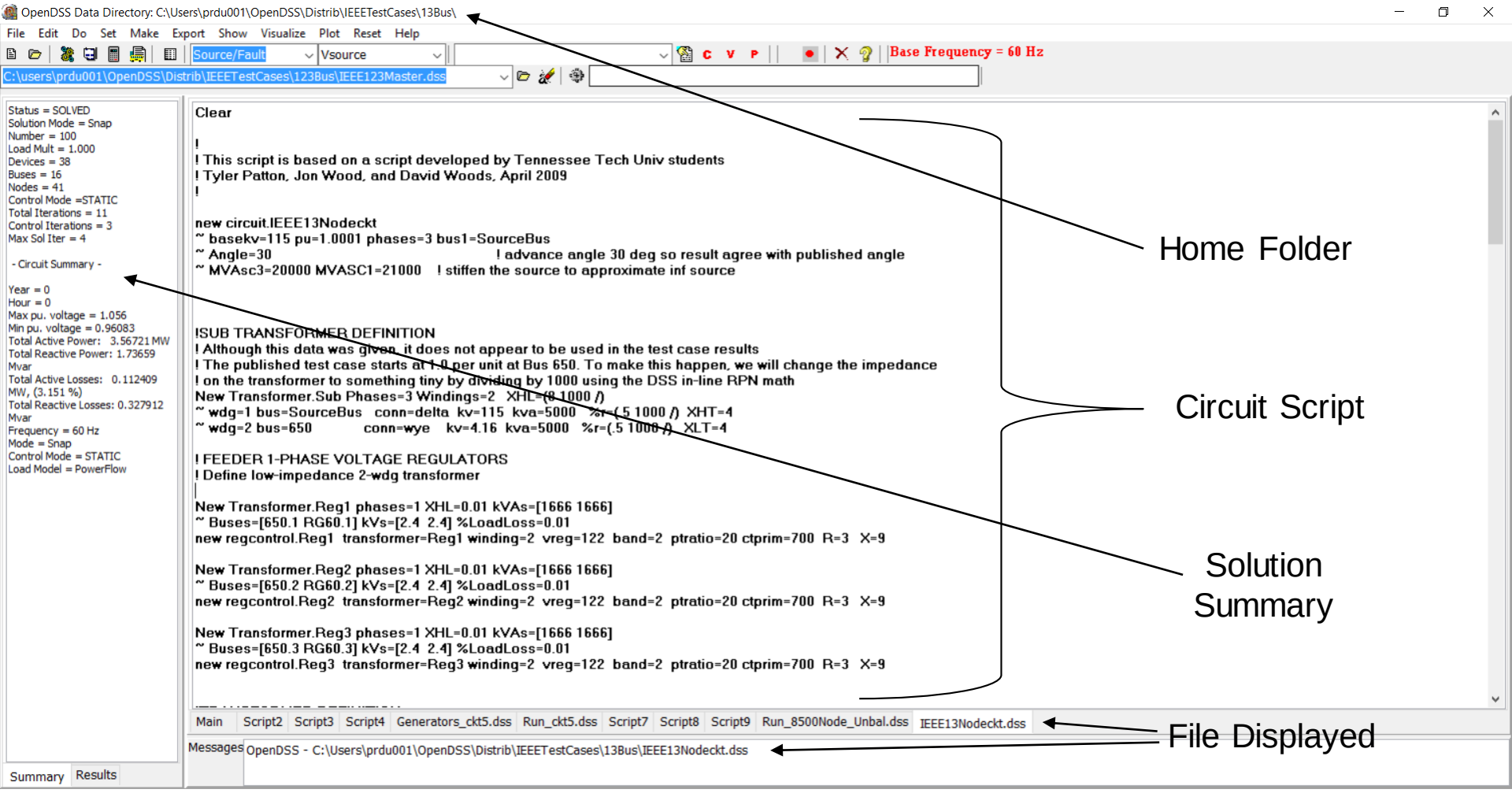
Desktop Icon





File Manager/Explorer

Basic User Text Script Screen (OpenDSS.exe)



(Live Demo)

Questions ??

Together...Shaping the Future of Electricity