Introduction to PowerWorld Simulator: Interface and Common Tools

I5: Data Aggregation using Areas,Zones, Interfaces, Super Areas,Injection Groups



2001 South First Street Champaign, Illinois 61820 +1 (217) 384.6330 support@powerworld.com
http://www.powerworld.com

Aggregation of Data

- Areas and Zones
- Interfaces
 - Flowgates, Cutplanes, and Paths can be defined as interfaces
- Nomograms
- Bus Pairs
- Super Areas
- Injection Groups
- Substations
- Difference Flows to compare different cases
 - values in the case (loads, gen MW outputs, etc...)
 - Also compare the topology of the case
- Owners, Balancing Authorities, and Data Maintainer

Area and Zone Records



- Area and Zone definitions are part of standard power system case text formats
- Each bus is assigned to exactly one area
- Each bus is assigned to exactly one zone
- Generators, Shunts, and Loads are normally assigned to the same area as their terminal bus
 - However, they may also be given their own area and zone designation

Area and Zone Layouts

- Areas and Zones do NOT have to be contiguous
- Zones are often "sub-areas", but this is NOT required. They can overlap as shown below
 - Areas (thick lines)
 - Zones (shaded/nonshaded)



 A single area may consist of multiple zones, while a single zone can include buses from multiple areas

What are Areas and Zones For?



- Areas and Zones
 - Provide summary data about a group of power system elements (total load, generation, losses, etc...)
 - Provide way to filter data (Area/Zone filters)
 - Limit Monitoring Settings for Area/Zone
 - Toggle settings for equivalencing, scaling, etc...
- Areas ONLY (control settings)
 - Ability to perform automatic generation control (AGC)
 - Ability to specify MW transfer between areas
 - Ability to toggle control settings across a group of elements
 - AGC, Generator AVR, Shunts, Transformers
 - Ability to enable OPF/SCOPF constraint enforcement

Assigning Area and Zone Designations

- To create a new Area or Zone
 - Open Model Explorer and choose Network →
 Buses or open the Bus Dialog and assign an existing bus to a new Area/Zone number; OR
 - Select Insert... from the local menu (right-click) in Area Records or Zone Records; OR
 - Auxiliary files or Copy/Paste from Excel

ו	Bus Reco	ords							
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		Number	Name	Area Num	Area Name	Nom kV	PU Volt	Volt (kV)	Enter a new number to
	1	1	One	4	←	135.00	1.05000	144.90	create a new Area
	2	2	Two	1	Тор	138.00	1.04000	143.5	
	3	3	Three	1	Тор	138.00	0.99269	136.9	
	4	4	Four	1	Тор	138.00	1.00000	138.0	
	5	5	Five	1	Тор	138.00	1.00665	138.9	
21	6	6	Six	2	Left	138.00	1.04000	143.5	
	7	7	Seven	3	Right	138.00	1.04000	143.5	

Moving Bus Zones and Creating New Zones via the Zone Dialog

X Zone Records X	Buses			
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Filter Advanced -	Zone	•		
Zone Num	Zone Name	Load MW	Load Mvar	Gen MW
1 1	1	760.00	130.00	767 9
		Display,	/Column Opti	ons
Show Zo Informa dialog	one tion	 Find Search for a search for	for Text cords phic Data View ggle/Columns aste/Send ed Filter ed Sort Expression Display 1) ontrol	Ctrl+F

- Buses can be assigned individually to zones using the Bus dialog.
- Groups of buses can be moved to different zones using the Zone Information dialog.
- The Zone Information dialog is available by right-clicking on the zone name on the Zone Records display.

Edit Mode Zone Information Dialog



Run Mode Zone Dialog



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Interface Definition



- Interfaces are groupings of branches and sometimes other elements
- The sum of the flows on these elements can then be monitored in the analysis tools
- Common interfaces are the grouping of tie lines between areas, and groupings of lines between important parts of the system.
- Interfaces can be used to model several commonly described groupings of lines
 - Flowgates term used in the Eastern United States
 - Cut-Planes term used in the Western United States
 - Paths term used in the state of California
 - Nomograms Used throughout the industry

Interface Records



- Interface records can be used to show flows between areas and/or zones.
- Interface records showing area to area flows can be automatically inserted by
 - Open Model Explorer and choose Aggregations →
 Interfaces to display interface records
 - Select Interface records → Auto Insert Interfaces
 from the local menu to display Auto Insertion of
 Interfaces Dialog

Interface Records



Interface Def	initions k to0 ;00 ∲	A A Re	ecords 🕶 Set	 Column: 	s * 📴 * 👹	88 - 488	• 🌱 🏥 • 🎬	⊞ c	ptions *	- • >	Auto Insertion of Inter Type of Interfaces to I Area to Area Zone to Zone	faces nsert		X
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: Search	rch Search Now C										Insert Interfaces	X Cancel] ? +	lelp

Right-click and select Interface records → Auto Insert Interfaces Select either Area to Area, or Zone to Zone flows

Defining Custom Interface Records

- Open Model Explorer and choose Aggregations →
 Interfaces to view the Interface display.
- Right-click and select
 Insert to add a new
 interface.
- The Interface Dialog is shown.
- We'll set up an interface showing flow on two parallel lines.

nterface Name	new interface		▼ ▲	Find Interf	ace		
Labels	1	Add Ne	ew Interface	Delete Inte	erface		
Limits (MW) Limit A	0.000	Monitoring Direction	Noncontingent I Con	1W Flow Tribution	0.7		
Limit B	0.000	© FROM> 10	Contingent I Con	1W Flow [tribution]	0.0		
Limit C	0.000	10> FROM	Total I	W Flow	0.7		
Limit D Limit E	0.000	Monitor Both Directions	PTDF V	alue (%)	0.00		
interface Element	s OPF Cus	tom					
Either Insert N	lew Element	Element Ide	ntifiers (mber)	me			
Clone Elements F or Right-Click to s	rom Another Int how the Elemen	terface Number (N	(Name) 🔘 Na	umber			
		Description		Flow	Weig	hting	Pre-Weight Flow
1 Line MW f	low from bus 'Ty	wo (2)' to bus 'Six (6)' cire	cuit 1	40.	07 41	1.00	40.07
		(), wood ocrem()				1.00	55.11

Monitored Interface Dialog

- Change Interface Name: *Top Export*
- Modify Interface Limit A (MW): 400
- Click Insert New Element button to add a new Interface Element
 - Type: Line/Transformer
 - Near : 2 (Two)
 - Far : 6(Six) CKT 1
- Repeat For
 - Type: Line/Transf.
 - Near : 5 (Five)
 - Far : 7 (Seven) CKT 1



Interface Element Type

- Line/Transformer
 - Monitor the flows on a line (direction is important!)
- Area to Area, and Zone to Zone
 - Monitor the sum of the flows on all tie lines
- Line Open/Close Contingency
 - When defining these, it means that all monitoring on this interface is done after this Line Open/Close contingency
- DC Line
 - Monitor the flow on a DC Line
- Injection Group, Generator, Load
 - Monitor the output of a group of generators or loads
 - Allows you to put a limit on the sum of outputs
- MS Line
 - Monitor the flow on a multi-section line
- Interface
 - Monitor the flow/output of another interface
 - Be careful not to create circular references

Monitored Interface Dialog





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Interface Element Weightings



- Right-click on the list of elements and choose
 Display/Column Options
- Add the columns Weighting and Pre-Weight Flow
- This allows your interface to monitor the *weighted sum* of flows instead of the pure sum
- This will be used extensively with Nomogram Definitions

Nomograms

 Nomograms allow definition of 2-dimensional limit spaces using 2 interfaces



Nomograms



- Open Model Explorer and choose Aggregations →
 Nomograms to bring up a list of Nomograms
- Right-click and choose Insert... to bring up the Nomogram Dialog for adding a new Nomogram
- A nomogram is defined by
 - Interface A
 - Interface B
 - A set of breakpoints
 - Breakpoints MUST create a "convex" region
- Nomogram limits can be used in ATC, contingency analysis, and OPF/SCOPF

Nomogram Dialog



Nomogram Interfaces

- For each nomogram, Simulator creates a list of nomogram interfaces which are managed internally
 - This is done by using element weightings based on Interface A, Interface B, and the Breakpoints
 - "number of breakpoints minus 1" nomogram interfaces are made



- The "monitoring" will then occur for each nomogram interface level.
 - Everywhere you see references to interfaces you will now also see references to nomogram interfaces

Nomogram Interfaces



- Once you have defined a Nomogram, then the Aggregations -> Nomogram Records tab will have a second sub-tab that lists the Nomogram Interfaces
 - Note: you can not edit Nomogram Interfaces directly. You must modify the Nomogram itself instead
 - Nomogram Interfaces are identified by their Nomogram Name
 - Nomogram Segment

No	mogram Records									
	🛄 🏥 🗏 沈 👀 🦛 🌺 Re	cords 🔹 Set 👻	Columns 👻 📴 🕶			Dptions -				
N	omograms Nomogram Interfaces									
	Nomo. Name	Nomo. Seg. Ir	nterface MW Flow	MW Limit	Percent	Monitor Direction	Lim A MW	Lim B MW	Lim C MW	Ha
	1 Example Nomogram	1	32.1	100.0	32.12	FROM -> TO	100.0	100.0	100.0) No
	2 Example Nomogram	2	72.9	104.0	70.12	FROM -> TO	104.0	104.0	104.0) No
	3 Example Nomogram	3	82.3	104.0	79.10	FROM -> TO	104.0	104.0	104.0) No
	4 Example Nomogram	4	78.7	100.0	78.74	FROM -> TO	100.0	100.0	100.0) No
<										>

Bus Pairs

- Bus Pairs can be used to compute voltage angle differences between buses



Area/Zone/Interface Oneline Graphics

- Oneline diagrams traditionally contain information regarding individual power system elements (buses, lines, generators, etc...)
- Simulator also allows you to create diagrams based off the aggregate data objects

Area Fields



- Area fields can be added to onelines to show a number of area fields.
- Area fields can also be used to specify base transactions.
- Second Secon
- By default, area fields are linked to the area associated with the closest bus on the oneline.

Area Field Dialog



Area number 0 (zero) represents the whole system!

Area Field Example



- Add several area fields to the B7FLAT case
 - Area Name
 - Area MW Flow to Other Area (or case)
 - Scheduled Flow to Other Area
 - Load Schedule Multiplier
 - AGC Status

B7FLAT with Area Fields



Area, Zone, and Super Area Objects



- Separate oneline object types for Areas, Zones, and Super Areas
- On B7FLAT case
- From the File Menu, select New Oneline to make a new oneline
- Add area objects for each of three areas
- From the File Menu, select Save Oneline to save the oneline. Use b7flata for the name.
- Zone and Super Area objects are similar

B7FLATA Display

Right-click on object, then select **Information Dialog...** for the Area Display Options



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Area or Zone Palette

- Similar to the Bus Palette, you can also bring up an Area or Zone Palette
 - On the Draw ribbon tab, select Show
 Insert Palette For → Zones (or Areas)



Zone Palette for Midwest.pwd			
History List	Define a Filter	🤁 <u>H</u> elp	
Displayed (7)	Displayed Neighbors	Undisplayed Neighbors	All Undisplayed (169)
190 (190)	WEST 8C (236)	EASTERN (201)	655 (655)
TVAWEST (265)	AP (1)	WESTERN (206)	69KV (142)
AEP-AP (50)	AEP-OP (51)	DUKE.DUK (210)	AE RIVER (180)
WEST 8C (236)	AEP-KP (54)	SOUTH 6B (235)	AEC (250)
AP (1)		WEST 8A (238)	AEP-CS (53)
AEP-OP (51)		VP 500KV (239)	AEP-IM (52)
AEP-KP (54)		TVAEAST (267)	AEP-IM-I (56)
		OVEC (6)	AEP-OP-I (55)
		AEP-CS (53)	APC (241)
		AEP-OP-I (55)	ASEC (546)

Interface Fields



- Several types of objects are used to display interface data on the oneline
 - Interface Objects: like transmission lines
 - Interface Fields: like line fields
 - Interface Pie Charts: like line flow pie charts

Auto Insertion of Interface Objects



- Interface objects can be auto inserted (just like line objects).
- In edit mode, from the Draw ribbon tab, select
 Auto Insert → Interfaces.
- Allows insertion of interfaces and pie charts.
- Interfaces are automatically anchored to area/zone objects.

Auto Insertion of Interface Objects



Select **OK** to auto insert the interface objects

With Interface/Area Fields



Super Areas



- Super areas are groupings of individual areas; analogous to an area being a grouping of individual buses
- Super areas can be used to control several areas together
- Open Model Explorer and choose Aggregations
 → Super Areas to see the Super Area Records
 - Right-click and select Insert...
 - Super Area Dialog is displayed with default name assigned to the new super area

Super Area Dialog



Super Area Dialog





Super Area ED Control for B7Flat Case





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Injection Groups



- Represents grouping of injections of power
 - Loads
 - Generators
 - Switched Shunts
 - Other Injection Groups (*be careful of circular references*)
- Useful for defining more specific groups of sources and sinks in many tools
 - Especially useful for ATC, PVQV tools; also for Sensitivities (PTDF, TLR, etc...)
 - Also useful for general reporting, e.g. make an aggregation of generators and show the sum of their output

Injection Groups



- Open Model Explorer and choose
 Aggregations → Injection Groups
 - Right-click, select Insert...
 - Injection Groups Dialog is displayed with default name assigned to the new injection group
 - Right-click in the Participation Points grid and Insert elements into the injection group or click Insert Points
- Auto Insertion also available from the local menu in Model Explorer

Injection Groups



Injection Group Participation Points



- Injection Groups are made up of "Participation Points" which have two main attributes
 - Reference to a generator, load, switched shunt, or another injection group
 - Participation factor
 - Note: this participation factor is *independent* of the generator object's participation factor
- When you create a participation point, you can define the initial participation factor for the point using various methods.
 - This is depicted on the following slide

Injection Group Participation Points: Participation Factors

- For a generator, the choices for participation factor are shown to the right
 - Specify particular value
 - Use generator's participation factor
 - Base on positive reserve (Max Present MW)
 - All units will hit their maximum at same time
 - Base on negative reserve (Present Min)
 - All units will hit their minimum at same time
 - Base on MW capability (Max MW)
 - Use Custom Floating Point Field
- Recalculate Factors Dynamically
 - Normally the participation factor will only be calculated at this time.
 - Check this box to automatically recalculate the factors EVERY TIME they are used
 - This way, if you use the injection group with a different case or different system state it will still be what you intend.

Participation Factors
O Specify a value:
Ose present participation factor
O Base on positive reserve
O Base on negative reserve
O Base on MW capability
🔿 Use Custom Field: 🛛 Cust Float 1 💌
Recalculate factors dynamically

Injection Group Display Objects



- You can also insert display objects which represent Injection Groups
- On the Draw ribbon tab, choose Aggregation
 → Injection Group
- Click on the oneline where you would like to place the injection group
- Display objects show the generation and load which exist inside the group



Substations



- Some substations in a power system have a large number of buses in them
 - Large power stations
 - Other important places in a power system
- Traditional Power System Cases do not have any reference to which "substation" a bus is inside (but this is changing)
- Simulator allows you to define this relationship and then create substation-based diagrams



Creating Substations

- To create a new Substation
 - Make sure you're in Edit Mode (for all methods)
 - Open Network → Buses in the Model Explorer or open the Bus Dialog and assign an existing bus to a new Substation number; OR
 - Select Insert... from the local menu (right-click) in Substation Records; OR
 - Auxiliary files or Copy/Paste from Excel



Substation Display Objects



- You can also insert display objects which represent Substations
- From the Draw ribbon tab, choose Aggregation
 → Substation
- Click on the oneline where you would like to place the injection group
- Note: You can also auto-insert transmission lines between Substation objects

Name of Substation Number of buses which are assigned to the substation Name of Substation Number of buses Which are assigned to the substation

Symbols indicates whether Generation, Load, or Shunts exist inside the substation

Difference Flows



- Simulator allows two different power system cases to be simultaneously loaded
 - Present Case
 - Base Case
- Difference flows allow viewing of either case or of the differences between the cases
- Changes in status are shown using OPEN/CLOSED fields (present case status listed first)

Difference Flows Dialog



- The Difference Flows dialog is used to control which case is being viewed.
- The Difference Flows dialog can be viewed by either
 - Difference Flows option on oneline local menu
 - Difference Flows on the Tools ribbon tab



Difference Flows Dialog



The difference flows options affect the onelines AND the case information displays

Load Increased by 20%



Difference Flows



You can NOT change values in the difference mode!

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Difference Flows: Change Mode

- Shows the present values of quantities that are different in the present case than in the base case
- Quantities that are equal (within tolerance) in both cases are blank

ſ	× Area	s X B	uses 🗙 Su	ubstations	× Inj Gr	oups X	Super Ar	eas 🗙 Nomo	ograms	× Interfa	aces X G	eneri 🔸 🕨
	8 😇 🖥	- - ₩ →	♦ 1.0 0.0	# #	👯 Reco	rds * Ge	o 🕶 Set 🕶	Columns -		t AUXD -	💎 🏥 🚽	50RT 124. —
				Les MRCD	1						9	HELD 🔶
4	Filter	Advance	d 🔻 Area			•				Find Re	emove Qui	ck Filter 🔻
		Area Num	Area Name	AGC Status	Gen MW	Load MW	Shunt MW	Tot Sched MW	Int MW	ACE MW	Lambda	Loss MW A
	1	10			2547.41	2781.16		-350.90	-350.78	0.12		117.03
	2	11		\rightarrow	1313.80	1882.00			-623.71	0.29		55.52
	3	14			22558.45	19289.28		2822.60	2823.61	1.01		445.56
	4	18	4		5093.24	6459.37	1.42	-1497.90	-1497.98	-0.08		130.43
	5	19	WAPA L.C.	Area Slack	3652.77	1150.73	0.00	2401.00	2400.92	-0.08	Off Control	101.12 Y
	6	20			2537.17	2794.19		-300.00	-300.50	-0.50		43.48
	7	21	IID		1652.61	1142.93		446.40	445.99	-0.41		63.69
	8	22			3918.60	4623.00		-878.00	-877.70	0.30		173.30
	9	24			15359.82	22529.33		-7559.00	-7559.62	-0.62		390.11
	10	26			5715.96	6671.65		-1294.80	-1294.77	0.03		339.09
	11	30			27596.35	27459.77		-880.00	-879.80	0.20		1016.38
	12	40	\rightarrow		30347.73	25283.03	0.86	3959.90	3960.90	1.00		1102.94
	13	50	-/		11292.33	7822.75		2900.00	2899.39	-0.61		570.20
┥	14	52			587.02	770.99		-200.00	-200.95	-0.95		16.98
	15	54			10977.80	11121.40			-459.72	0.28		316.13
	16	60			2462.51	3579.40		-1253.00	-1253.00	0.00		136.11
	17	62			3148.82	2072.15		958.40	958.35	-0.05		118.31
	18	63	WAPA U.W.		55.74	-51.50		100.80	100.70	-0.10		6.54
	19	64			2637.66	2393.10		168.00	167.63	-0.37		76.94
	20	65			10635.11	9314.16	-0.01	986.90	986.64	-0.26		334.33
	21	70			7840.07	8165.08		-469.00	-469.23	-0.23		144.23
	22	73			6575.65	5406.26		1022.60	1022.46	-0.14		146.93

Comparing Two Different Case Files



- Simulator only allows one case to be open at a time.
- When you open a case, all information about the previously opened case is removed, with one exception
 - The Difference flows information is kept
- Thus to compare two cases, you
 - Open case #1, and go to Run Mode
 - Open Difference Flows and choose Set Present as Base Case
 - Open case #2
 - Open Difference Flows and change to Difference Case

Topological Comparison of Cases



On the Tools ribbon tab, choose Difference Flows →
 Present Topological Differences from Base Case ...

Go to folders for detailed lists

how to view by	Summary										
weemoved/Both By Type	Difference Mode OPresent	Base	e 🔿 Diffe	rence 💿	Change Show Present Bas	e in Differe	nce and Cha	ange (Change Toleran		
Summary New (15750) Removed (9422) Both (73314) Create Bus Swap List	Below is a summary of the comparison between the present case: 18HS4.epc and the base case: 16HS3a.epc saved from the Difference Flows Dialog. For summary table statistics, show counts using Area/Zone/Owner/DataMaintainer filtering										
	Element Type	New	Removed	Both	Element Type	New	Removed	Both	\leftarrow		
	Bus	1716	773	20493	Area	1		21			
	Load	1098	681	10036	Study MW Transactions	8		45			
	Switched Shunt	666	308	2596	Balancing Authority	42		1			
	Generator	424	276	3787	Zone	31	11	457			
	Reactive Capability	5118	3774	1546	Owner	72	11	502			
	Branch	3390	2267	24073	Super Area						
	Transformer Correction	3		27	Data Maintainer						
	Transformer	1691	1055	8518	Interface			70			
	3W Transformer	254	49	538	Interface Element	49	49	261			
	Line Shunt	39	49	159	Bus Pair						
	DC Transmission Line	2		4	Injection Group	1					
	Voltage Source Converter DC L				Participation Point	62					
	Multi-Terminal DC Record			2	Substation	992					
	Multi-Terminal DC Bus			8	Multi-Section Line	52	119	121			
	Multi-Terminal DC Transmission			6	Model Group	39					
	Multi-Terminal DC Converter			4	Nomogram						
	Voltage Control Group				Limit Set			1			
	Voltage Droop Control				Rating Set Name Branch			15			
					Rating Set Name Bus			4			
					Rating Set Name BusPair			4			
					Rating Set Name Interface			15			

Set tolerances for different fields for use in **Change Mode**

 Columns show the number of new, removed elements
 New: elements in the present case which are not in the base case

Removed: elements not in the present case which were in the base case Both: element in the present case and the base case

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Topological Differences: Elements Removed Tab

Removed → Network

→ Branch provides a
 list of branches in the
 Base Case that are
 not found in the
 Present Case

 Link Status: provides reason they were not found in the Present Case

		cume has	e Areas /Zones /	where and	Data Maintai	ners that ar	a not in press	ant case mee	t the filte
By New/Removed/Both B	/ Type	source bus					- not in prese		
I Summary	Differ	ence Mod	e OPresent	OBase	Obiffere	ince I Cr	hange L	Show Prese	ent Base
New (15750)	Eleme	ents which	exist in the base	e case: 16H	S3a.epc				
A Removed (9422)	buch	ot the pre	sent case: 10h5	ч.ерс					
▲	2) Ren	noved∖Ne	twork\Branch (22	267)					
⊞ BUS (7/3) ⊞ Load (681)		.	.0. 0. ∳k *. 0	8 44 44	Records *	Set - Co	lumns 👻 📴		?
III Switched S	hunt (30:		Link Status	Erom	From Name	From Nom	From		From Ar
Generator	(276)		LINK Status	Number	From Name	kV	Name_Nomi	Name	Num
Reactive C	apability						kV _		
Branch (22	67)	1 No T	o Bus	10004	ALCAZAR	115.00	ALCAZAR_1	NEW MEXIC	
Transforme	er Correc	2 No F	rom Bus	10398	YAHALL11	115.00	YAHALL11_	NEW MEXIC	
Transforme	er (1055)	3 No F	rom Bus	10051	BROARN11	46.00	BROARN11	NEW MEXIC	
III 3W Transf	ormer (45	4 No T	o Bus	10024	B-A	115.00	B-A_115.0	NEW MEXIC	
	(49)	5 No B	ranch with ID	10025	B-A	345.00	B-A_345.0	NEW MEXIC	
Voltage So	urce Con	6 No F	rom Bus	10378	SANB-A12	345.00	SANB-A12_	NEW MEXIC	
Multi-Termi	nal DC R	7 No T	o Bus	10030	BALLP_T	46.00	BALLP_T_4	NEW MEXIC	
Multi-Termi	nal DC BL	8 No T	o Bus	10039	BEV_WOOD	115.00	BEV_WOOD	NEW MEXIC	
Multi-Termi	nal DC Tr	9 No T	o Bus	10048	BROADWAY	46.00	BROADWAY	NEW MEXIC	
🖽 Multi-Termi	nal DC C	U NO F	rom Bus	10158	FI_CAP11	46.00	FI_CAP11_	NEW MEXIC	
Voltage Co	otrol C		rom Bus	10399	YAHWINDII	115.00	YAHWND11	NEW MEXIC	
🗰 Voltage Dr	oop Cont	2 NO F	rom Bus	10190		46.00		NEW MEXIC	
Aggregation (190)		om bus	10140	CL-CL-14	46.00	EL-EL-14_4	NEW MEXIC	
Both (73314)		5 No T	o Bus	10103		115.00	EMBLIDO 1	NEW MEXIC	
E Create Bus Swap L	IST	6 No F	rom Bue	10103	NE SUB	115.00	NE SUB 11	NEW MEXIC	
		Z No T	o Bus	10107	FT MARCY	46.00	FT MARCY	NEW MEXIC	
		8 No F	rom or To Bus	10109	FL-FL-11	46.00	FL-FL-11 4	NEW MEXIC	
		9 No F	rom or To Bus	10110	EL-EL-12	46.00	EL-EL-12 4	NEW MEXIC	
		0 No E	rom Bus	10507	NE SUB	115.00	NE SUB 11	NEW MEXIC	
		1 No F	rom Bus	10270	PERHAZ11	46.00	PERHAZ11	NEW MEXIC	
		2 No F	rom Bus	10132	HW-11	115.00	HW-11 115	NEW MEXIC	
		3 No F	rom or To Bus	10146	EL-EL-13	46.00	EL-EL-13 4	NEW MEXIC	
		4 No F	rom Bus	10175	EMBJUA11	115.00	EMBJUA11	NEW MEXIC	
	<						-	-	3

Owners

- Like Areas and Zones:
 - each Bus is assigned to exactly one Owner
 - Gens/Loads/Shunts typically belong to the Owner as their terminal Buses, but they may be assigned to different ones
 - Can be used to select objects for System Scaling
- Generators, Shunts, and Branches may have multiple owners with associated ownership percentages
- Can be used Case Information Display filtering (Area/Zone/Owner/DataMaintainer Filters)

Balancing Authority

- Like Areas and Zones:
 - each Bus is assigned to exactly one Balancing Authority
 - Gens/Loads/Shunts typically belong to the Balancing Authority as their terminal Buses, but they may be assigned to different ones
- Balancing Authority is used primarily for aggregation of quantities like total generation/load

Data Maintainer



- Designate entities responsible for maintaining the input data for objects in the model
 - Provides contact information: name, email, phone number
 - Some features allow a user to write out only the data that belongs to a particular DataMaintainer
- Can be used for Case Information Display filtering (Area/Zone/Owner/DataMaintainer filters)
 - enable first in Simulator Options → Case Information
 Displays