

SG-Net Smart Grid Use Case Database and Traffic Planning Tool

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June 22, 2011**

Table of Contents

Introduction.....	4
The GNU General Public License.....	5
The System Diagram.....	6
The System Requirements Spreadsheet.....	7
The User Profile.....	7
Queries.....	11
Application Level Query Analysis.....	11
Network Level Query Analysis.....	11
Traffic Analysis.....	12
Alternate Path Application Level Query Analysis.....	12
Arrival Rate Calculations.....	15
Smart Grid Spectrum Allocation Support	16
Distribution Automation (DA) Device Density	16
The Spectrum_Scenarios Form	16
Automatic Metering Infrastructure (AMI) Device Density	17
Demographic Data.....	17
Department of Energy U.S. Energy Information Administration.....	17
The Census Tract Data.....	18
Appendix A: Data Parsing Documentation.....	20
Data Parsing.....	21
Software License.....	21
Revision Note.....	22
Appendix B: Table Documentation.....	26
Actors	26
AlternativePathConnections.....	27
AlternativePathParsingReview.....	28
AlternativePathReportData.....	28
AltPathExporttoCSV.....	29
AnnualElectricSalesByState.....	29
Application2ApplicationConnections	30
Application2ApplicationWithBracketHierarchy.....	30
ApplicationConnectionsExportToCSV.....	31
ApplicationQueryReportData.....	33
AuditData.....	33
CensusTracts2000.....	34
CensusTractTraffic.....	34
CensusTractTrafficAnalysis.....	34
CloudCrossings.....	35
Counties.....	35
CountyTraffic.....	35
County Traffic Analysis.....	35

DemographicAnalysis.....	36
Documentation_Reference.....	36
Domains.....	36
ExcelAppConnectionsImport.....	37
ExcelPayloadSecurityImport.....	37
Hourly_Traffic.....	38
MicrowaveFrequencyBands.....	39
NetConExportToCSV.....	39
NetworkCrossings.....	39
NetworkQueryReportData.....	40
Network_Connections.....	40
NIST_ACTORS.....	41
NIST_Domains.....	41
NIST_LogicalConnections.....	41
Organizations.....	41
Payloads.....	42
PayloadType.....	42
Profiles.....	42
ProfileDailyTraffic.....	44
ProfileHourlyTraffic.....	44
SavedAltPathConnections.....	45
SavedScenarios.....	46
SpectrumScenarios.....	46
SavedUserApplicationProfileRecords.....	47
SavedUserNetworkProfileRecords.....	48
States	48
ScenariosDailyTraffic.....	49
Transmission_Media.....	49
UseCases.....	49
UtilityProfileExportToCSV.....	50
WirelessFrequencyBands.....	51
UtilityProfileReportData.....	52
Appendix C – Modules.....	54

Introduction

This documentation and user manual addresses an Access Database of Use Cases compiled by the SG-Networks Task Force within the Open SG Users Group. A number of software routines are discussed that have been developed to provide better insight into the data. The data is generated and stored with a Systems Requirements Spreadsheet. This reflects a variety of alternative connections within the Smart Grid based on a System Diagram.

The database was originally conceived as a vehicle for making the SG-Networks Use Case data searchable and more usable. At this instant in time, the number of individual records is over 7000 and growing based on the 19 Use Cases shown. The objective of SG-Networks is to document approximately 30 Use Cases.

A key element of the tool is a Utility Profile wherein a user can specify the number and types of meters, substations, field devices, data aggregation points, etc. Basic infrastructure calculations are provided to provide average distances between entities, service areas around substations, etc. for later wireless coverage planning. Also included are system parameters that support construction of message payloads, and subsequent traffic planning.

Queries are structured in three primary areas:

- Network-Centric views of Actor to Actor communications links and cloud (network) crossings allow examination of traffic at the physical layer level, although no provisions currently exist for protocol overheads.
- Application Level (Level 7) views of Payload Source to Target composite communications links allow analysis of specific payload routes.
- Alternative Paths of the Application Level connections allow the user to examine the various alternatives that exist for routing payloads from Source to Target Actors.

For the Alternative Path queries, traffic analysis routines and graphics have been developed, and these are discussed through the body of this document.

Software was written to routinely map the data from the System Requirements Spreadsheet into appropriate database tables. This software is documented in Appendix A.

Numerous database tables have been developed to support this tool. Appendix B is devoted to a discussion of the tables, and explaining the purpose of each one.

The database starts with a copy of the data from the System Requirements Specification. Tables of Actors, Use Cases, Payloads, Payload Types, etc. are added. A table of Network Cloud Crossings is established from the System Diagram. At the current time, this is being done manually, although a spreadsheet macro could automatically scan the Visio code for diagram and generate such a table.

Traffic Analysis combines the Payload information with transmission timing information from the How Often column and the Daily Clock Periods columns of the Requirements Specification. Addition of a User Profile section allows multiple users to generate and save analysis data.

The software is currently configured to support three modes of operation:

- (1) Run Simple Queries, which can be viewed in a report, or exported to a CSV file
- (2) Run Queries and Scale the Results Using Selected Scenarios based on Demographic data for Counties and Census Tracts. At the time of this writing, the data is taken from the Census of 2000.
- (3) Run Queries and Scale the Results Using a detailed User Profile.

The GNU General Public License

Each routine in the software contains the following license statement.

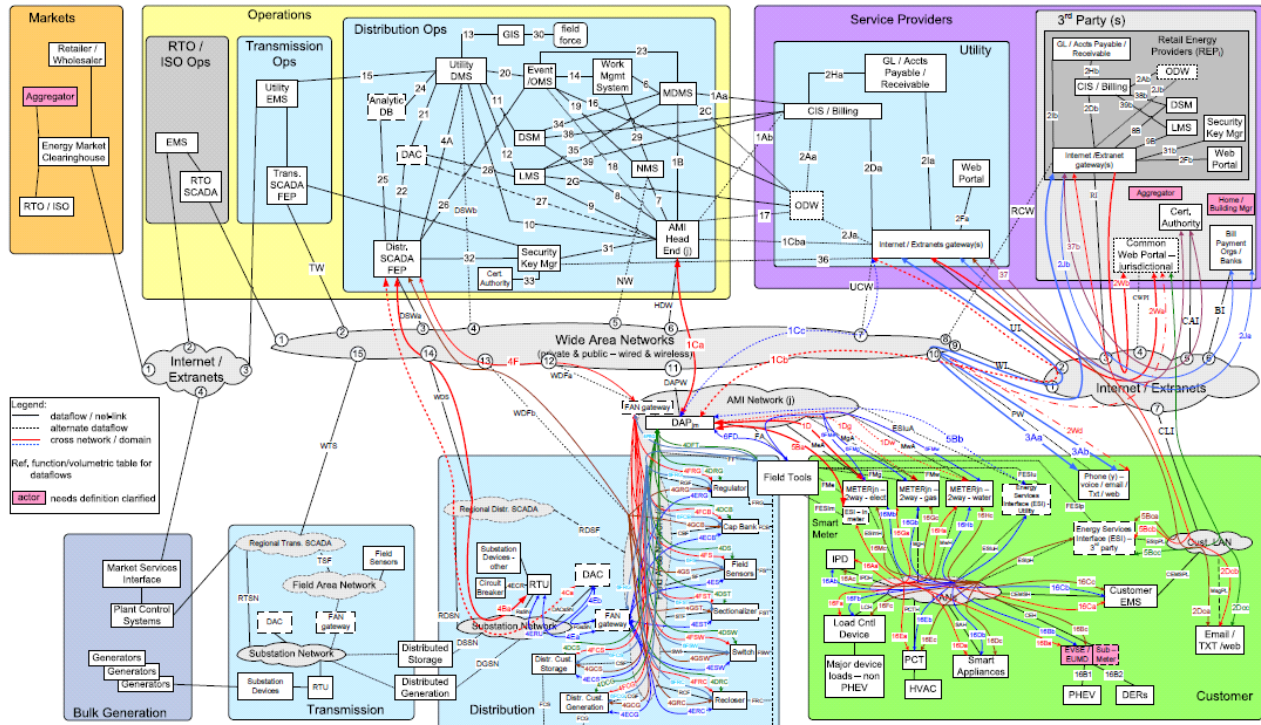
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The System Diagram

The diagram shown here is representative, and no attempt is made to display the most current rendition.

Smart Grid Conceptual Actors / Data Flow Diagram – Cross Domain Network Focused – OpenSG / SG-Network TF

DRAFT 11Apr2011
Base – file SG-NET-diagram-0.7b.vsd
page size: ANS-D



The System Requirements Spreadsheet

The spreadsheet shown here is representative, and no attempt is made to display the most current rendition.

1	2	A	B	C	D	E	F	G	H
		Rqmt Ref	Row Type	Data Flow Ref (min set that includes opts) - SG-Net Diag r0.7a	Data Flow from Actor	Data Flow to Actor	Use Case Re	Requirements (assumed electric unless noted otherwise)	Payload Name - Specific Data/Mesg (Logical - info content the same)
	1	MR-001	P	1Aa	CIS/Billing - Utility	MDMS	Meter Reading	CIS/Billing - Utility shall be able to send bulk meter read information requests to MDMS	bulk_Mtr-read_cmd
	2	MR-005	P	1B	MDMS	AMI Head-End	Meter Reading	MDMS shall be able to send bulk meter read information requests to AMI Head-End	bulk_Mtr-read_cmd
	3	MR-006	P	1Aa	MDMS	CIS/Billing - Utility	Meter Reading	MDMS shall be able to process & send bulk meter read information data to CIS/Billing - Utility	bulk_Mtr-read_resp-data
	4	MR-013	P	1B	AMI Head-End	MDMS	Meter Reading	AMI Head-End shall be able to process & forward on-demand meter read data to MDMS	bulk_Mtr-read_resp-data
	5	MR-036	P	[1Dg or (16Ga + 5Ba) or (16Gb + 5Bb)] + [1Ca or (1Cb + 1Cba) or (1Cc + 1Cba)]	2-Way Meter - Gas C/I	AMI Head-End	Meter Reading	2-Way Meter - Gas (Commercial/Industrial) shall be able to send multi interval-data meter reads data to AMI Head-End	Mtr-read_multi-interval-data_resp-data
	6	MR-037	P	[1Dg or (16Ga + 5Ba) or (16Gb + 5Bb)] + [1Ca or (1Cb + 1Cba) or (1Cc + 1Cba)]	2-Way Meter - Gas Resdnt	AMI Head-End	Meter Reading	2-Way Meter - Gas (Residential) shall be able to send multi interval-data meter reads data to AMI Head-End	Mtr-read_multi-interval-data_resp-data
	16								

The User Profile

The user profile supports the modeling of a given utility or a specific area within a utility. Each user is automatically assigned a unique User Index that is automatically written to analysis outputs when the User selects the "Save" Button.

The parameters are quite detailed, as the following screens attest.

UtilityProfile : Form

MICRONET-1 Export to CSV Report Save to Utility Profile

Note: Data Entries in this demonstration version of the planning tool are assigned strictly for the purpose of development, test and checkout. They do not reflect any specific Utility Network.

Infrastructure | Customer | Metering | Substations and Field Devices | DSDR/DA Field Maintenance - Centralized Control

UTILITY		SYSTEM PARAMETERS			
Project	MICRONET-1	Number Firmware Upgrades Per Month	5		
Author	Jerry Armes	Number DAP Update Events Per Day	6800		
Company	Micronet				
Utility Service Area (Square Miles)	9286				
ELECTRIC METERS		SUBSTATIONS		PHEV	
Total Number Electric Meters	2250000	Total Number Substations	1200	Total Number PHEV	3000
Average Number Electric Meters Per Square Mile	242.3	Average Number Substations Per Square Mile	.1	Average Number PHEV Per Square Mile	.3
Average Meter to Meter Separation Distance (Miles)	.1	Average Substation to Substation Separation Distance (Miles)	6.3	Average PHEV Coverage Area	3.1
Average Coverage Area (Square Feet) Per Meter	.004	Average Coverage Area Per Substation (Square Miles)	7.7	Average Distance Between PHEV Locations (Miles)	.7
Average Radius (Miles) of Each Meter Coverage Area	.1	Average Substation Service Area Radius (Miles)	3.1	Average Number PHEV per DAP	10.0
GAS METERS		DATA AGGREGATION POINTS (DAPS)			
Number C/I Gas Meters	4000	Total Number DAPS	300		
Number Residential Gas Meters	4900	Average Number Meters Per DAP	7540.0		
Total Number Gas Meters	12000	Average Number DAPS Per Square Mile	.032		
TOTAL METERS		Average Coverage Area Per DAP (Square Miles)	31.0		
Total Number Meters	2262000	Average Radius (Miles) of Each DAP Coverage Area	6.3		
		Average Distance (Miles) Between DAP Locations	12.6		

Record: 1 of 1

UtilityProfile : Form

MICRONET-1 Export to CSV Report Save to Utility Profile

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Infrastructure | Customer | Metering | Substations and Field Devices | DSDR/DA Field Maintenance - Centralized Control

SYSTEM PARAMETERS	
Number Customers with Utility EMS	200000
Number Customers With Customer EMS	20000
Number Customers With IHD	9000
Number of Demand Response Customers	7600
Number PHEV Charging Events Per Day	10000

Record: 1 of 1

UtilityProfile : Form

MICRONET-1 Export to CSV Report Save to Utility Profile

Note: Data Entries in this demonstration version of the planning tool are assigned strictly for the purpose of development, test and checkout. They do not reflect any specific Utility Network.

Infrastructure Customer Metering Substations and Field Devices DSDR/DA Field Maintenance - Centralized Control

ELECTRIC METERS		SYSTEM PARAMETERS	
Number Smart Meters	22500000	Number Meters That Lose Power Per Day	100
Number Smart Meters With NIC	15000000	Number PHEV Meters Accessed Through ESI Non-Smart Meter	24000
Number Smart Meters With ESI	200	Number PHEV Meters Accessed Through Smart Meter ESI	6000
Number of Electric C/I Meters	4000	Number Utility Customer Premise Browser Users PrePay Enrollment Per Premise Meter	2500
Number of Residential Electric Meters	20000	Number Utility Customer Premise Browser Users PrePay UnEnrollment Per Premise Meter	7000
Total Number Electric Meters	2250000	Number REP Customer Premise Browser Users PrePay Enrollment Per Premise Meter	8000
Number PHEV Meters	3000	Number REP Customer Premise Browser Users PrePay UnEnrollment Per Premise Meter	4000
Number PrePay Meters with IHD	2500	Application Error Event Per Meter Per Day	5
Number PrePay Meters With Customer EMS	3000	Number Switch Operations Per Meter Per Day	10000
Number PrePay Enrollments	500	Number Switch Operations Per PrePay Meter Per Day	2800
Number PrePay Enrollments Per Day	15000	Number On-Demand Commands Per Meter Per Day	1000
Number PrePay UnEnrollments Per Day	5000	Number of Smart Meter Bulk Message Batches Per Day	2500
Number PHEV Meter Connections Per Day	3400	Number of Smart Meters In Each Bulk Message Batch	25000
Number PrePay Meters	5000	Number Common Web Portal PrePay Meters	7000
GAS METERS		Number Utility PrePay Meters	500000
Number Gas C/I Meters	4000	Number REP PrePay Meters	7000
Number Gas Residential Mete	4900		

Record: 1 of 1

UtilityProfile : Form

MICRONET-1 Export to CSV Report Save to Utility Profile

Note: Data Entries in this demonstration version of the planning tool are assigned strictly for the purpose of development, test and checkout. They do not reflect any specific Utility Network.

Infrastructure Customer Metering Substations and Field Devices DSDR/DA Field Maintenance - Centralized Control

SUBSTATIONS		SYSTEM PARAMETERS_FCIR MESSAGING	
Number Distribution Substations	1000	Number Field Devices Per Distribution Substation	5750
Number Transmission Substations	200	Number Field Devices Per Transmission Substation	3000
Total Number Substations	1200	Number DAC SubStation Distribution Storage Units	10000
FIELD DEVICES		Number of Daily Dispatch Periods for SubStation Distributed Storage Units	2600
Number Distribution Field Area Network (FAN) Gateways	500	Number of Substation Distributed Storage Unit Power Loss Events Per Day	2000
Number Distribution Regulators	500	Number Locked Out Devices Per Faulted Circuit	100
Number Capacitor Banks	500	Number Locked Out Reducer Devices Per Faulted Circuit	3000
Number Distribution Field Sensors	500	Number In-scope Faulted Primary Circuit (with tie circuits) Reconfig Switch Devices	240
Number Distribution Sectionalizers	750	Number In-scope Faulted Primary Circuit (with tie circuits) Isolation Devices	3000
Number Distribution Switches	500	Number In-scope Faulted Primary Circuit (with tie circuits) Isolation Reducer Devices	3000
Number Distribution Reducers	500	Number In-scope Faulted Primary Circuit (with tie circuits) Isolation Switch Devices	3000
Number Distribution Customer Storage Units	500	Number In-scope Faulted Primary Circuit (with tie circuits) Isolation Sectionalizer Devices	3000
Number Distribution Customer Generation Units	500	Number Circuit Reconfiguration Steps Per SubStation	3000
Number Distribution DAC	500	Number Primary Circuit (with tie circuits) Breakers	3000
Number Distribution SCADA RTU	500	Number Zone Isolation Steps Per SubStation Per Day	3
Number Distribution Circuit Breakers	500	Number Operate Device Request Messages Per Hour	10
		Number Operate Device Request Ack Messages Per Hour	20
		Number Fault Lock Out Alarm Messages Per Hour	15
		Number Self Initiation Status Response Messages Per Hour	2

Record: 1 of 1

UtilityProfile: Form

MICRONET-1 Export to CSV Report Save to Utility Profile

Note: Data Entries in this demonstration version of the planning tool are assigned strictly for the purpose of development, test and checkout. They do not reflect any specific Utility Network.

Infrastructure | Customer | Metering | Substations and Field Devices | DSDR/DA Field Maintenance - Centralized Control

Number Feeder CBC New Configuration Messages Per Hour	20	Number Feeder Voltage Regulator New Configuration Messages Per Hour	20
Number Feeder CBC New Configuration Ack Messages Per Hour	10	Number Feeder Voltage Regulator New Configuration Ack Messages Per Hour	20
Number Feeder Sensor New Configuration Messages Per Hour	20	Number Feeder Voltage Regulator Step Up Command Messages Per Hour	20
Number Feeder Sensor New Configuration Ack Messages Per Hour	2	Number Feeder Voltage Regulator Step Up Command Ack Messages Per Hour	20
Number Feeder Switch Sensor Data Request Messages Per Hour	15	Number Feeder Voltage Regulator Step Down Command Messages Per Hour	20
Number Feeder Switch Sensor Data Reply Messages Per Hour	15	Number Feeder Voltage Regulator Step Down Command Ack Messages Per Hour	20
Number Feeder Switch Open Command Messages Per Hour	10	Number Feeder Voltage Regulator Sensor Data Request Messages Per Hour	20
Number Feeder Switch Sensor Open Command Ack Messages Per Hour	15	Number Feeder Voltage Regulator Sensor Data Response Messages Per Hour	20
Number Feeder Switch Close Command Messages Per Hour	15		
Number Feeder Switch Close Command Ack Messages Per Hour	15		
Number Feeder CBC Open Command Messages Per Hour	3		
Number Feeder CBC Sensor Open Command Ack Messages Per Hour	15		
Number Feeder CBC Close Command Messages Per Hour	15		
Number Feeder CBC Close Command Ack Messages Per Hour	15		
Number Feeder CBC Sensor Data Request Messages Per Hour	20		
Number Feeder CBC Sensor Data Reply Messages Per Hour	15		

Record: 1 of 1

Queries

A variety of queries are possible in the software. The primary ones are described in this section.

Application Level Query Analysis

When no parameters are selected by the user, the resulting query is unfiltered, and presents everything in the underlying table as an output.

When selections are made, as shown in the following screen, the number of records that meet all of the stipulations called out by this user naturally results in a smaller number of output records.

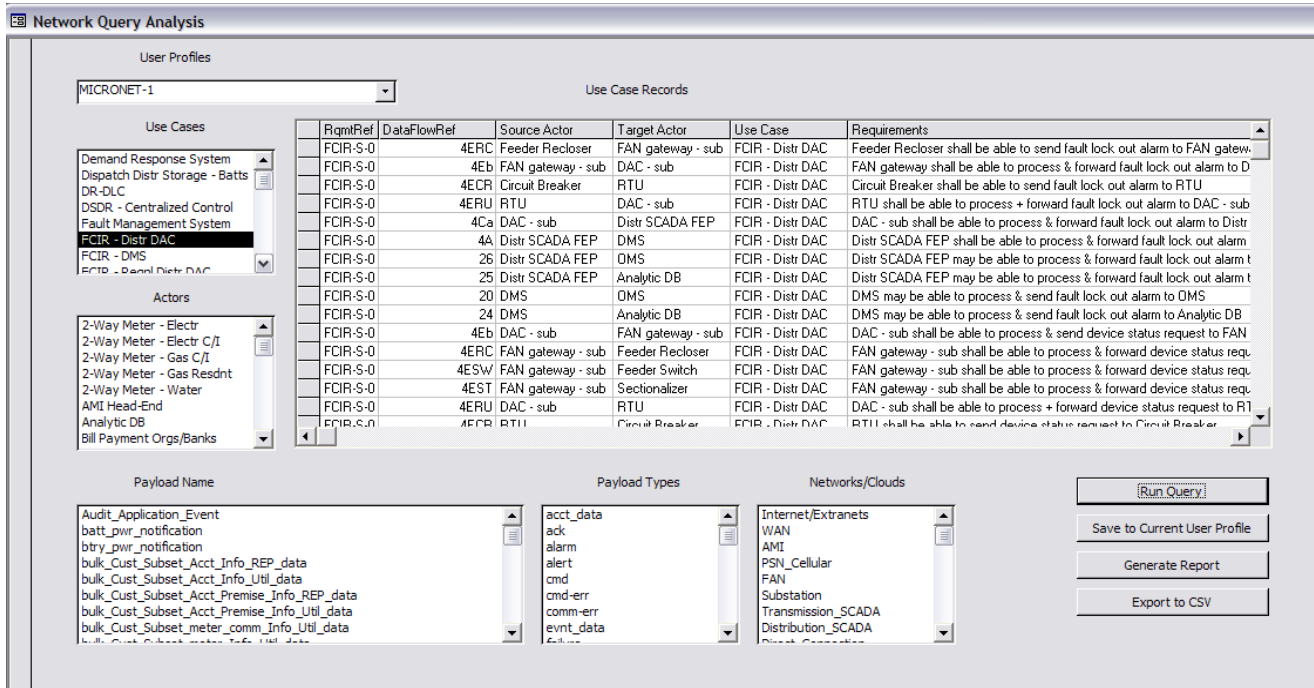
The screenshot displays the 'Application Level Query Analysis' window. It features a 'User Profiles' dropdown set to 'MICRONET-1' and a 'Use Case Records' table. The table has columns for RqmiRef, DataFlowRef, Source Actor, Target Actor, Use Case, and Requirements. Below the table are three filter sections: 'Actors' (with 'AMI Head-End' selected), 'Payload Name' (with 'cmd' selected), and 'Networks/Clouds' (with 'Internet/Extranets' selected). A 'Run Query' button is visible on the right.

RqmiRef	DataFlowRef	Source Actor	Target Actor	Use Case	Requirements
MR-005		1B MDMS	AMI Head-End	Meter Reading	MDMS shall be able to send bulk meter read information requests to /
FPU-001	[1Ca or (1Cba +	AMI Head-End	2-Way Meter	Firmware / Program	AMI Head-End shall be able to process & send metrology firmware up
FPU-007	[1Ca or (1Cba +	AMI Head-End	2-Way Meter	Firmware / Program	AMI Head-End may be able to process & send metrology firmware up
FPU-013	[1Ca or (1Cba +	AMI Head-End	2-Way Meter	Firmware / Program	AMI Head-End may be able to process & send metrology firmware up
FPU-026	[1Ca or (1Cba +	AMI Head-End	2-Way Meter	Firmware / Program	AMI Head-End shall be able to process & send NIC firmware update r
FPU-032	[1Ca or (1Cba +	AMI Head-End	2-Way Meter	Firmware / Program	AMI Head-End may be able to process & send NIC firmware update t
FPU-038	[1Ca or (1Cba +	AMI Head-End	2-Way Meter	Firmware / Program	AMI Head-End may be able to process & send NIC firmware update r
FPU-051	[1Ca or (1Cba +	AMI Head-End	ESI - In Meter, ESI	Firmware / Program	AMI Head-End shall be able to process & send ESI firmware update r
FPU-057	[1Ca or (1Cba +	AMI Head-End	ESI - In Meter, ESI	Firmware / Program	AMI Head-End may be able to process & ESI-In-Utility firmware updat
FPU-063	[1Ca or (1Cba +	AMI Head-End	ESI - In Meter, ESI	Firmware / Program	AMI Head-End may be able to process & ESI-In-Utility firmware updat
FPU-076	[1Ca or (1Cba +	AMI Head-End	DAP	Firmware / Program	AMI Head-End shall be able to process & send DAP firmware update
FPU-087	[1Ca or (1Cba +	AMI Head-End	2-Way Meter	Firmware / Program	AMI Head-End shall be able to process & send metrology program up
FPU-093	[1Ca or (1Cba +	AMI Head-End	2-Way Meter	Firmware / Program	AMI Head-End may be able to process & send metrology program up
FPU-099	[1Ca or (1Cba +	AMI Head-End	2-Way Meter	Firmware / Program	AMI Head-End may be able to process & send metrology program up
FPU-112	[1Ca or (1Cba +	AMI Head-End	2-Way Meter	Firmware / Program	AMI Head-End shall be able to process & send NIC program update r
FPU-118	[1Ca or (1Cba +	AMI Head-End	2-Way Meter	Firmware / Program	AMI Head-End may be able to process & send NIC program update t

Network Level Query Analysis

The network level query examines records from the Network_Connections table. These are considered child records in the sense that they map the connections between actors at the network level. Consequently, for each parent record at the Application level, there will typically be several interim child records that define the intermediate actor-actor communications for the network.

This analysis should be limited to network designers, as without judicious selection of query parameters, one can easily double or triple count the same traffic flow as it proceeds along the path through multiple successive actors.

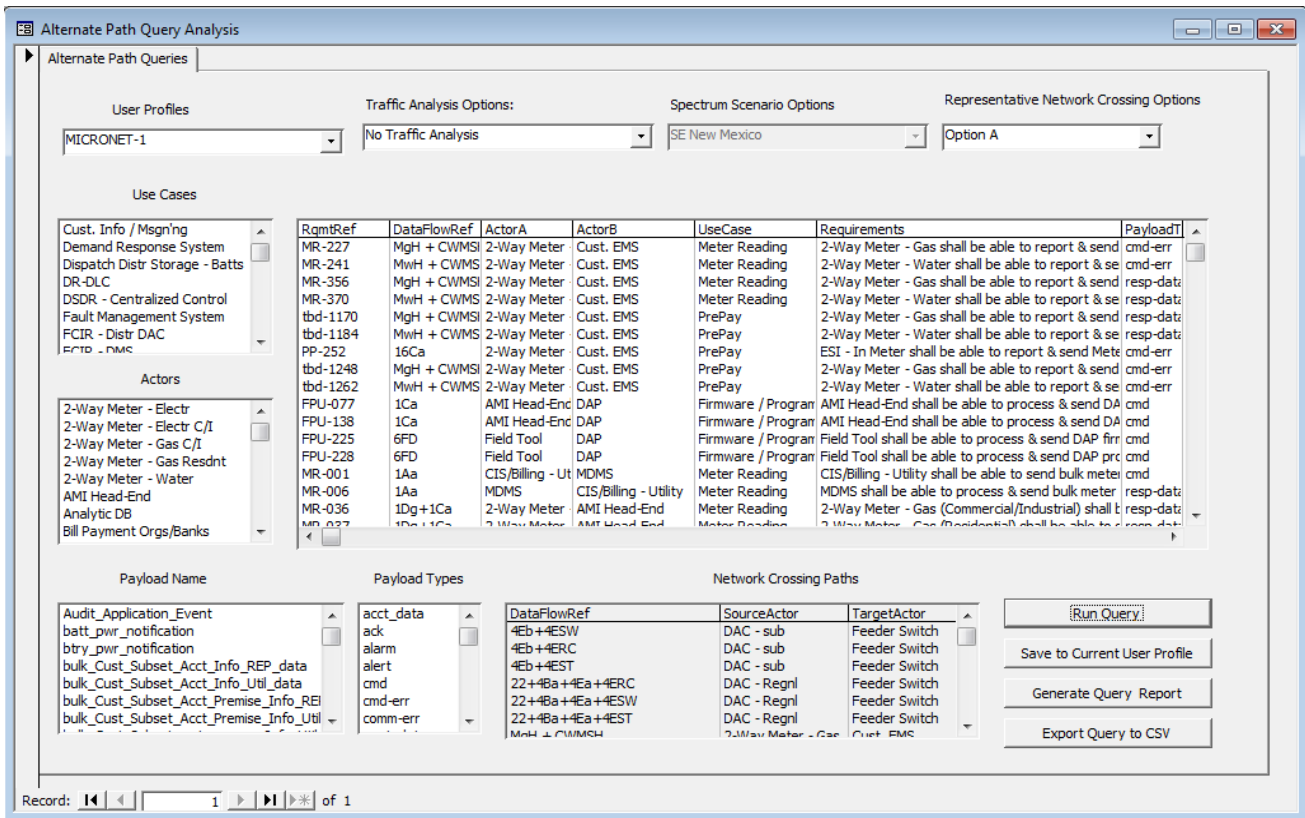


Traffic Analysis

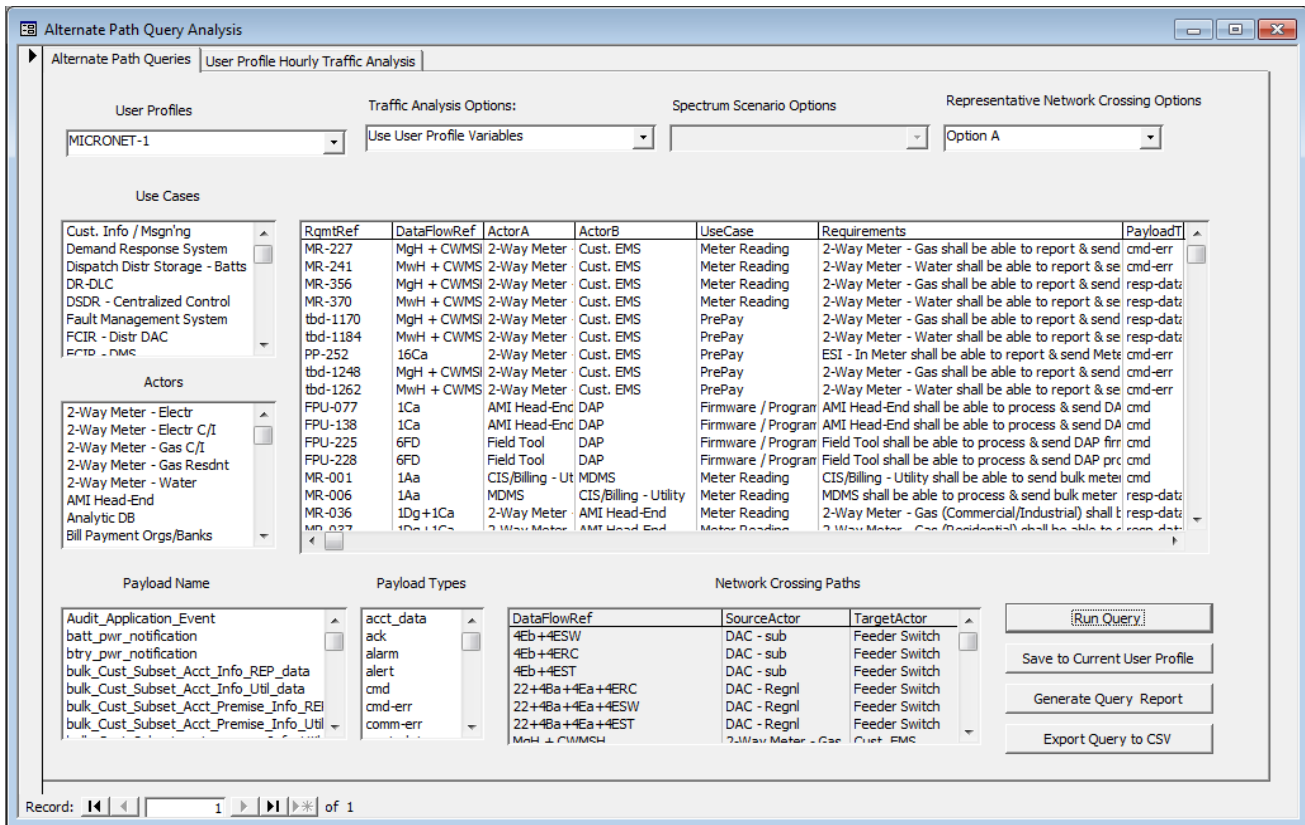
Individual Records contain Payload Length in Bytes, Source Actor and Target Actor. Payload data contains no protocol overhead of any kind. The DailyClockPeriods column describes when message transmissions take place within a 24 hour day. The How Often column provides details of when the message is sent, and on what basis. Software routines have been written to parse the How Often column and allow the aggregation of traffic on a uniform basis.

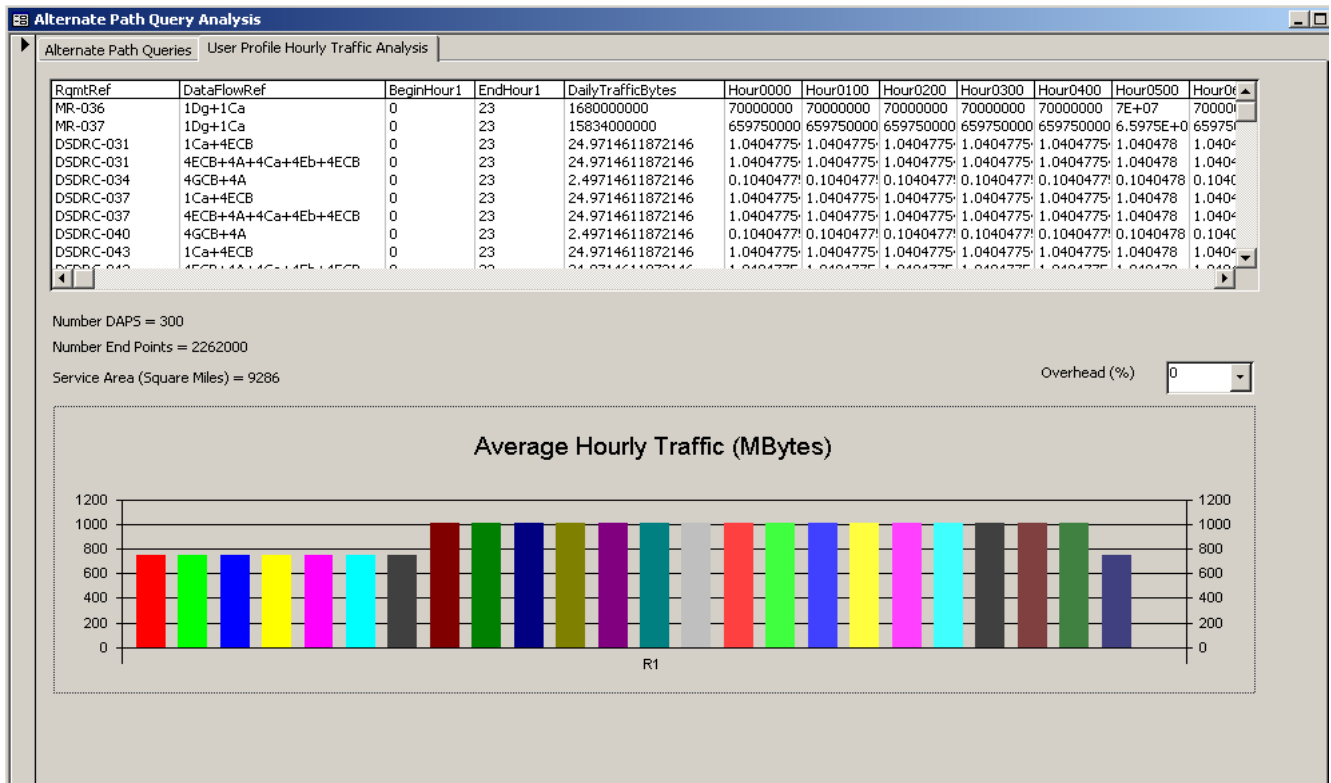
Alternate Path Application Level Query Analysis

As described briefly in the introduction, there are three modes of traffic analysis, each constructed on the Alternate Path Query Analysis. The first is a Simple Query. A sample screen is given here.

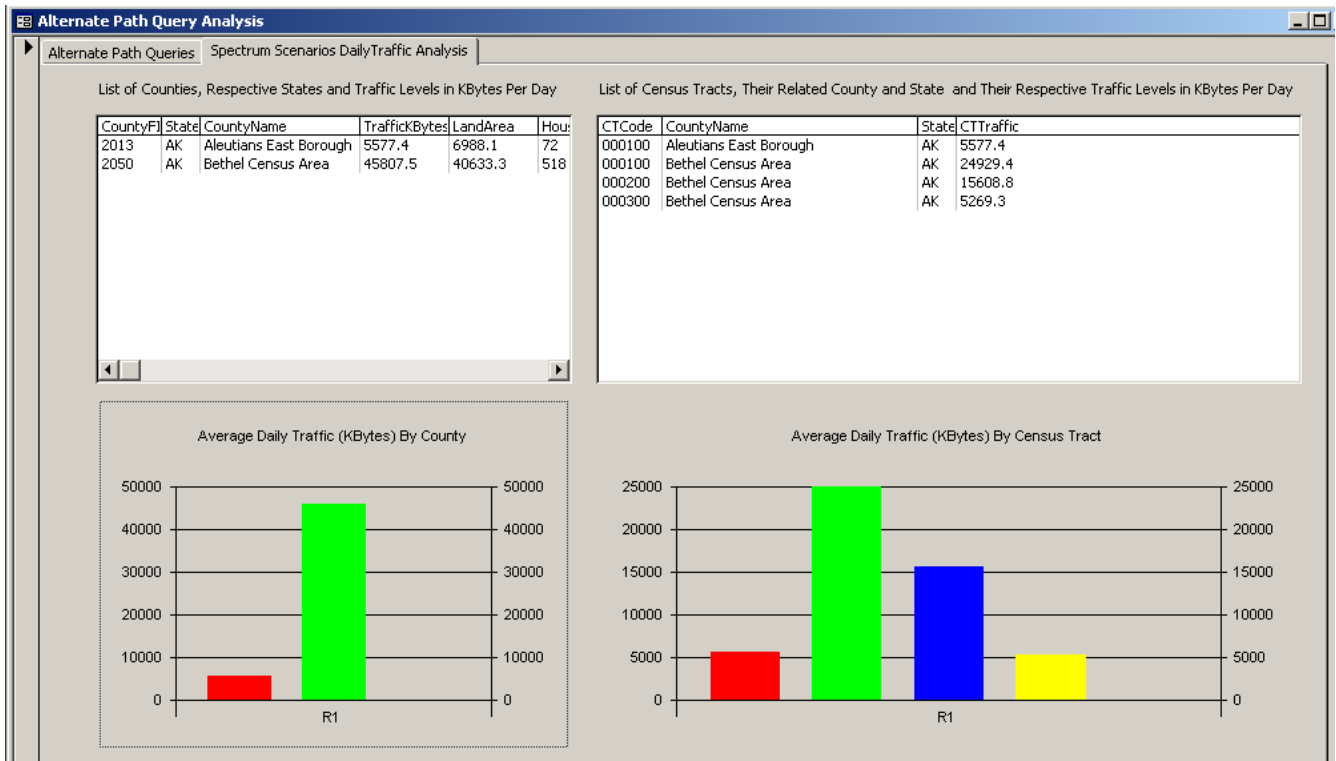


The second is the Query scaled by the User Profile. That is shown in the following graphics.





The third is the use of demographic data and the Spectrum Scenario parameters. The example given reflects counties in Alaska.



Arrival Rate Calculations

Arrival Rate calculations have been provided in the program to support future queueing analysis models. These are provided regardless of whether the User Profile is used for Traffic Scaling or Demographic data is utilized. In the former case, the data is included in the last column of the **ProfileDailyTraffic** table. In the latter, the calculation is included in the last column of the **ScenariosDailyTraffic** table.

Two reports, entitled **Arrival Rates - Demographic Traffic Scaling** and **Arrival Rates - Profile Scaled Traffic** summarize the data.

Arrival Rates - Profile Scaled Traffic

<i>RqmtRef</i>	<i>UseCase</i>	<i>DailyClockPeriods</i>	<i>Payload Bytes</i>	<i>culatedDailyTraffic</i>	<i>Arrival Rate (Payloads/Hour)</i>
MR-036	Meter Reading	24x7	200	168000000	3500
MR-037	Meter Reading	24x7	200	1883400000	329875
DSDRC-031	DSDR - Centralized Control	From 1-6 1/dt/ratba ,fro	250	24.9714611872146	0.0041619101978691
DSDRC-031	DSDR - Centralized Control	From 1-6 1/dt/ratba ,fro	250	24.9714611872146	0.0041619101978691
DSDRC-034	DSDR - Centralized Control	From 1-6 1/dt/ratba ,fro	25	2.49714611872146	0.0041619101978691
DSDRC-037	DSDR - Centralized Control	From 1-6 1/dt/ratba ,fro	250	24.9714611872146	0.0041619101978691
DSDRC-037	DSDR - Centralized Control	From 1-6 1/dt/ratba ,fro	250	24.9714611872146	0.0041619101978691
DSDRC-040	DSDR - Centralized Control	From 1-6 1/dt/ratba ,fro	25	2.49714611872146	0.0041619101978691
DSDRC-043	DSDR - Centralized Control	From 1-6 1/dt/ratba ,fro	500	24.9714611872146	0.00208095509893455
DSDRC-043	DSDR - Centralized Control	From 1-6 1/dt/ratba ,fro	500	24.9714611872146	0.00208095509893455
DSDRC-046	DSDR - Centralized Control	From 1-6 1/dt/ratba ,fro	25	1.24857305936073	0.00208095509893455
DSDRC-055	DSDR - Centralized Control	From 1-6 1/dt/ratba ,fro	500	24.9714611872146	0.00208095509893455
DSDRC-058	DSDR - Centralized Control	From 1-6 1/dt/ratba ,fro	25	1.24857305936073	0.00208095509893455
DSDRC-067	DSDR - Centralized Control	From 1-6 1/dt/ratba ,fro	250	149.828767123288	0.0249714611872146
DSDRC-073	DSDR - Centralized Control	From 1-6 1/dt/ratba ,fro	250	149.828767123288	0.0249714611872146
MR-113	Meter Reading	24x7	200	452400000	94250
MR-123	Meter Reading	7AM - 6PM	25	1413750	5140.90909090909
MR-045	Meter Reading	7AM - 10PM	100	5655000	3770
SS-036	Service Switch	8AM - 8PM	25	84825	282.75

Smart Grid Spectrum Allocation Support

A logical application of the database is in supporting wireless frequency allocations by the FCC. In order to make the case, it is essential that multiple areas be examined, and this is done using a combination of standard utility industry practices combined with data from the Bureau of the Census and the Department of Energy U.S. Energy Information Administration (EIA).

Distribution Automation (DA) Device Density

The following assumptions are based on informal discussions with engineering teams in various utilities. In that sense, they represent typical values being applied.

For every 1400 end point clients served, a feeder line will be required. For each feeder line, an average of one recloser and two switches will be required. The number of Capacitor Banks required will be calculated on the number of residential and commercial clients served. Residential power factors are assumed to be approximately 85% uncorrected, while commercial clients are assumed to be approximately 90% uncorrected. An average Capacitor Bank rating of 12.5 KVAR is assumed and the calculations use 95% corrected power factor. Industrial clients are assumed to manage their own power factors and do not require assistance from the utility. For every three capacitor banks utilized by the utility, one voltage regulator will be required

The Spectrum_Scenarios Form

In the event the user feels that other parameters are more appropriate for his/her application, these can be readily changed using the Spectrum_Scenarios form as shown here.

This particular form is still a work in progress, and additional expansion is likely in forthcoming upgrades.

The screenshot shows a web-based form titled "Spectrum_Scenarios". The form is organized into several sections:

- User Profile Options:** Includes a dropdown menu for "MICRONET-1".
- Wireless Area Coverage Frequency Band Selection:** Includes a dropdown menu for "3650 - 3700".
- Spectrum Scenario Options:** Includes a dropdown menu and three buttons: "Report", "Export to CSV", and "Save Spectrum Scaling Parameters".
- Propagation Model Selection:** Includes a dropdown menu for "Hata".
- Backhaul Frequency Band Selection:** Includes a dropdown menu for "Lower 6 GHz".
- Scenario Information:** A table with fields for "Project" (MICRONET-1), "Author" (Jerry Armes), and "Company" (Micronet).
- Configuration Parameters:** A table of input fields for various parameters:

Average Number Feeders Per Sub	2.5
Number of End Points Per Feeder	1400
Number Reclosers Per Feeder	2
Number Switches Per Feeder	1
Uncorrected Residential Power Factor (%)	85
Uncorrected Commercial Power Factor (%)	90
Corrected Power Factor Objective (%)	95
Average Capacitor Bank Rating (KVAR)	12.5
Ratio of Capacitor Banks to Voltage Regulators	3

The bottom of the form shows a status bar with "Record: 1 of 7", a search box, and navigation icons.

Automatic Metering Infrastructure (AMI) Device Density

Each end point client served is assumed to have an electric meter and a gas meter. Both meters are assumed capable of two-way communications. Traffic projections include both.

Wireless Data Aggregation Point (DAP) coverage is assumed to eventually be in use everywhere, even in the remotest parts of remote areas. This seems counterintuitive at first, but in an era of electrically powered cars, charging stations will likely become ubiquitous. The use of electric motors for tractors and large farm machinery can be expected to follow the acceptance and widespread use of electric vehicles for transportation. This means charging stations along the sides of fields and on ranches. Each charging station will likely become a separate customer end point with a meter, and will drive the need for more feeder lines as well.

Demographic Data

The Bureau of the Census has published alphabetical listings of counties, county subdivisions, places, and census tracts in Gazetteer files¹ from the 2010 census that detail land and water areas plus latitude and longitude. Population data and extrapolations thereof from the 2000 census provide population and housing data at both the state and county level. The current timetable listed by the Bureau indicates that rural updates of this data will not be released until the January 2013 time frame.

Department of Energy U.S. Energy Information Administration

The Department of Energy publishes monthly statistics by state for a statistical sample of large utilities, typically about fourteen per state. For each of these, residential, commercial, industrial and total sales are tabulated as well as the number of customers served in these respective categories.² This makes it relatively simple to establish ratios within a state that define the average monthly electrical power consumption for each category of meter as well as the average over all meter types. It also becomes possible to establish the number of commercial and industrial meters per residential meter for scaling in those areas where limited data is available.

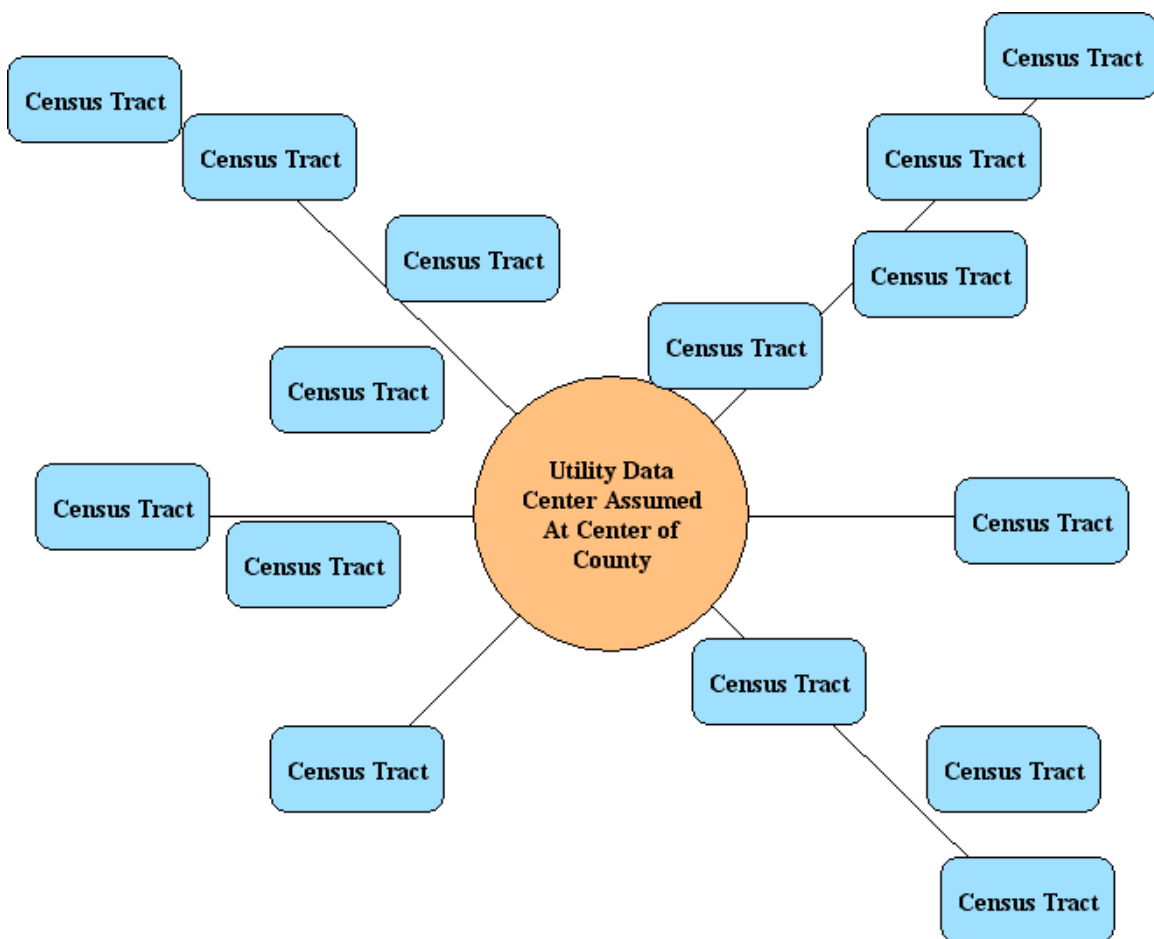
¹ <http://www.census.gov/geo/www/2010census/>

² <http://eia.doe.gov/cneaf/electricity/page/eia826.html>

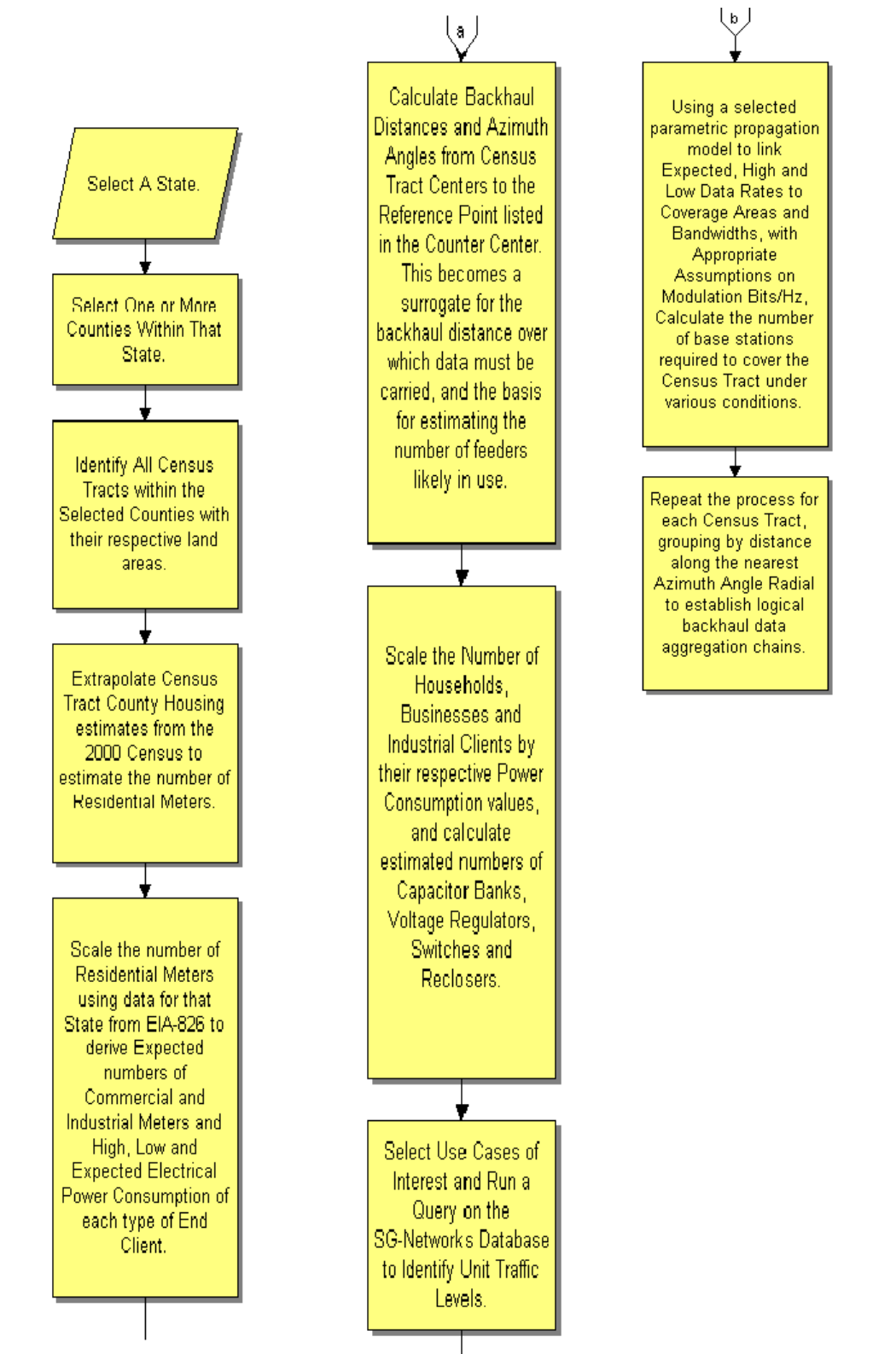
The Census Tract Data

In order to not miss small populations in remote areas, it is necessary to use Census Tract data. However, since there are so many of them, a logical aggregation is the County level. This is convenient in the sense that Latitude and Longitude are published for each Census Tract and for each County.

If the central command center for a Utility is placed at the center of each county for the purposes of spectrum studies, there will be multiple Census Tracts that fall on any given azimuth angle, and it will be necessary to aggregate them logically in order to structure the loading on the backhaul network. The relationship is illustrated by the following graphic, although the backhaul calculations have not yet been included in the software as of this writing.



An overview of the process is given in the following flow diagram.



Appendix A: Data Parsing Documentation

A number of tables and related software routines have been developed to support this effort. The starting point is a table named *ExcelAppConnectionsImport*. This table should be initially cleared by erasing all rows of data in it. Then the rows of the Excel Spreadsheet making up the current version of the SG Network System Requirements Specification Excel spreadsheet file can be copied and pasted into the *ExcelAppConnectionsImport* table. It is worth noting that while *ExcelAppConnectionsImport* table is not an indexed table, all other tables in the database are auto-indexed for data integrity.

Upon successful completion of this paste operation, it is necessary to scan this table for Null Fields as there will be empty cells in the ***SG Network System Requirements Specification*** Excel spreadsheet file. Running the Module named ***ScanForNull***, examines each field in the ***ExcelAppConnectionsImport*** table and inserts "tbd" into any Null fields.

The next routine to be run is called Table Mapper. This routine searches the ***ExcelAppConnectionsImport*** table, and maps both the Parent and Child Rows to two additional tables. Parent rows are placed in the ***Application2ApplicationConnections*** table while Child rows are placed in the ***Network_Connections*** table.

In both of these tables, the exact bracket nomenclature from the ***SG Network System Requirements Specification*** Excel spreadsheet file are maintained.

For further analysis of the Parent Rows, an additional working table is provided named ***Application2ApplicationWithBracketHierarchy***.

Mapping into this table from the ***ExcelAppConnectionsImport*** table is done with a Module named ***TableMapperWHierarchy***. To ensure data consistency across various authors, a routine named ***ReBracket*** is used to standardize the brackets for various levels in accordance with the following table.

Bracket Level	Bracket Type
Level 1	[]
Level 2	{ }
Level 3	()
Level 4	< >
Level 5	\$ %
Level 6	/ \
Level 7	- _
Level 8	: ;
Level 7	^ ~
Level 8	' ,

Data Parsing

Since the parent rows describing application-to-application connections often contain alternative routing, it is desirable to break these down into the alternative specific routes the message may travel. This is done using a routine called DFR_Parser.

This routine has to accomplish two things. First, a parsing operation is done to extract each of the data segments of the Data Flow Record (DFR) and isolate them for later use in building alternative routes. However, to support the reconstruction process, their bracket levels, aggregations (+) and OR statements must be carefully logged.

The second operation is the construction of the individual alternative routes and mapping of them to the **AlternativePathConnections** table.

Finally the records in the **AlternativePathConnections** table represent alternative paths as first recorded in the **SG Network System Requirements Specification** Excel spreadsheet file and mapped to the **Application2ApplicationConnections** table.

However, they were generated by analysis of the **Application2ApplicationWithBracketHierarchy** table and consequently are indexed to that table.

Since queries and reports will need to maintain the original bracket formatting of the **Application2ApplicationConnections** table, it is essential that the indexes of the records in the **AlternativePathConnections** table reflect the parent record in the **Application2ApplicationConnections** table and not the **Application2ApplicationWithBracketHierarchy** table.

A module to accomplish this task has been written and named **RePoint**.

Software License

Each software routine in the database includes the following license statement.

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Revision Note

In a recent data revision, the System Requirement spreadsheet was changed to allow the grouping of Security-related parameters to be placed on a separate tab. This includes the following columns:

- Candidate NIST LIC
- Security Confidentiality
- Security Integrity
- Security Availability

In addition, the Implications column was replaced in the new format with a Rationale & Comments Column. The new tab is shown here.

SG Network System Requirements Specification v5.0-draft1a.xls [Compatibility Mode]							
	A	B	C	D	E	F	G
1					Electric Only		
2	Payload Name	Payload Type	Description	Application Payload-attributes (excludes comm packet fields), date-time-stamps assumed for all payloads	Security LICs - NISTIR 7628 - associated to Payloads	Non-Functional Application Payload C-I-A	Non-Functional Application Payload C-I-A Risk Values (and/or LIC) - Rational & Comments
3	Audit_Application_Event	ack	Meter sends Meter event to Operations actor e.g. MDMS, occurs when a preconfigured criteria is met e.g.: a) failure or exception in an execution of an application or out of band/bounds condition; b) not able to service request or request timed out; c) system activity	Meter ID, event type/Code	13	L-M-M	C - none to minimal harm to customer or organization for access to/disclosure of payload data; I - a false negative or false positive ack code associated to a specific meter may lead to an incorrect next workflow process execution that may lead to serious effect on safe reliable operation of the meter; A - not receiving this payload from a specific meter might lead to lead to an inappropriate action/operation being taken that may have a serious effect on safe reliable electric operation of the meter;
4	batt_pwr_notification	alarm	Indication that network or end-point device is running solely on battery power	Device ID, status of mains power	13, 20	L-L-L	C - none to minimal harm to customer or organization for access to/disclosure of payload data; I - a false negative or false positive payload attributes associated to a specific device may lead to an unnecessary health check of the device; A - not receiving this payload from a specific device may lead to device becoming unavailable for it's intended role when battery power is drained, at which point lose of communication with device would eventually be detected.
5	bulk_Cust_Subset_Acct_Info_REP_data	resp-data	CIS/Billing - REP sends several large files (batches) of REP account information to the REP's ODW per day	Account ID, Premise ID, Premise address, billing address, Meter ID, payment history, current billing, general account information (programs enrolled in) - Utility meter customers	7	H-M-L	C - severe to catastrophic harm to customer or organization for access to/disclosure of payload data; I - inaccurate data (specific to more than one account), may lead to an incorrect next workflow process execution that may lead to serious lost of Customer trust and increased frustration with REP, and/or complaint filed with jurisdiction; A - not receiving this payload would create stale data for a batch of accounts and may trigger an immediate retry or retry at next file transfer period

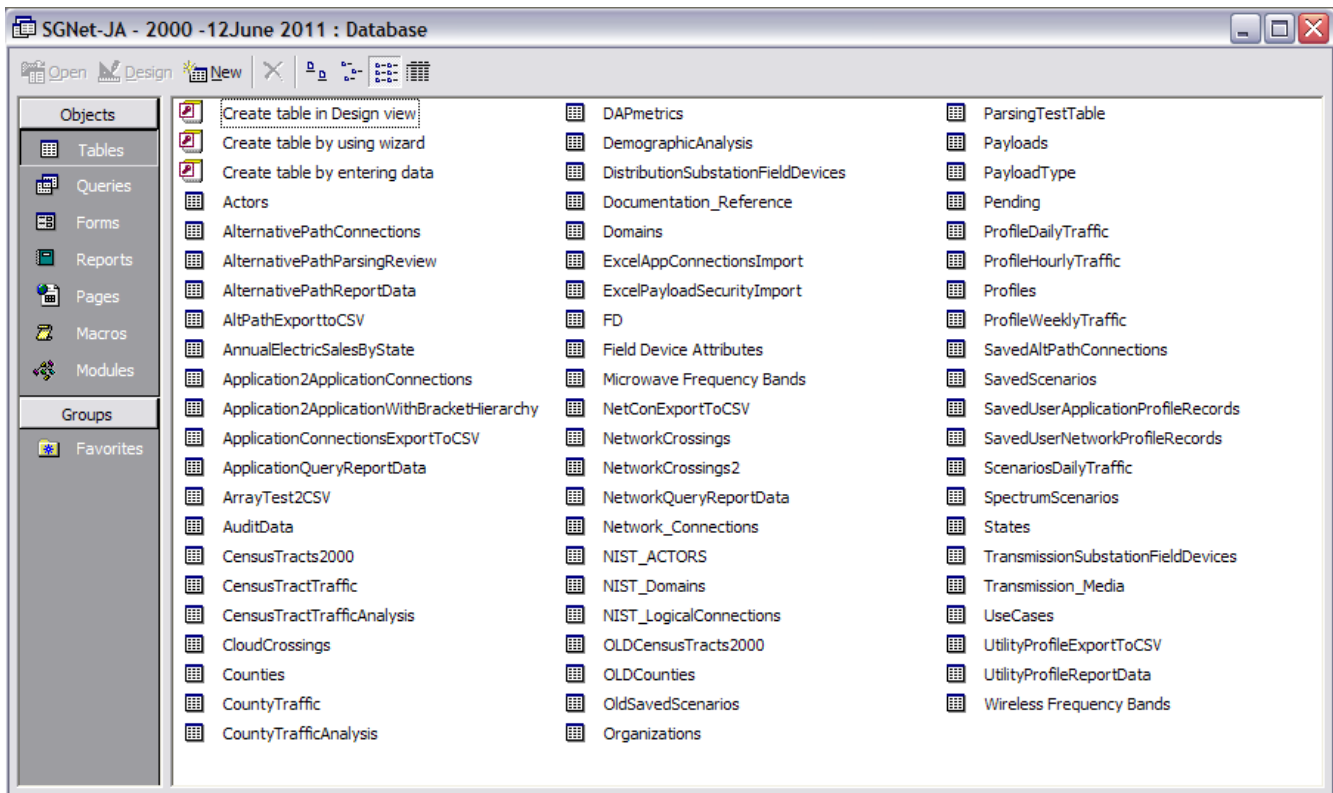
It was agreed within SG-Networks that the database should hold the data from this tab in the Payloads Table, and that has been done. However, the end result has been addition of an import file such that the software will be looking in the My Documents folder for a CSV file called **SRGN.csv** in order to import this data. To create this file, the user will need to export the contents of the new tab as shown above.

When creating the file, the delimiter should be set to the colon symbol (:), whereas normally CSV stands for comma-separated-variables. The use of the colon was required because commas are used liberally in the text of various columns. The user should be cautioned that anytime a colon is used in a text expression, the software will read it as intent to change columns.

Normally, the approach to raw data input has been to simply highlight the spreadsheet data desired, Copy and Paste into an empty database table. It was originally done this way to minimize separate import files with names and locations that had to be managed. That approach works for six of the seven columns on the new tab, but not with the Rationale & Comments column. For reasons that only Microsoft could fathom, that column simply refuses to be copied and pasted into a single database column. Hence the use of the import file.

A new module called Payload Security must be run to read the file and load the data into a new table called **ExcelPayloadSecurityImport**. A second routine called **PayloadTableUpdating** is then run to check the fields of the existing Payload table, edit those that exist, and add new rows as necessary. After populating the Payload table, it also checks and inserts "tbd" into any empty field to avoid software processing errors. The form queries remain unchanged.

Appendix B: Table Documentation



Actors

This auto-indexed table holds descriptions of all of the system actors as defined by SG-Network. These are not necessarily the same as the original actors as proposed by NIST, which are described in the NIST_ACTORS table. An index is included in the Actors table to allow linkage to NIST_ACTORS when the definitions are comparable. Another index is included to allow linkage to the Domains table. Provision has been made for English Names to be assigned to the actors, and provision also exists to designate whether or not each actor is included in the Systems Requirement Specification (SRS). Finally, an attribute index has been included for future growth, wherein an Actors Attributes table can be added in the future if needed, for use in detailed analysis and/or simulations.

Actors : Table	
Field Name	Data Type
ActorIndex	AutoNumber
Descriptor	Text
DomainIndex	Number
OrganizationIndex	Number
Diagram	Yes/No
EnglishName	Text
InSRS	Yes/No
NISTActorIndex	Number
AttributeIndex	Number

AlternativePathConnections

When Application level (Level 7) connections are made defining the transmission of a given Payload message originated by a Source Actor and delivered to a Target Actor, a parent record will be entered into the System Requirements Spreadsheet, and the Data Flow Reference will be a complex equation that defines multiple alternative routes that the payload can travel across the network. When the data from the System Requirements Spreadsheet is read by the parsing software of Appendix A, it breaks down this complex Data Flow Reference into discrete components, each of which is a unique path across the grid. These individual paths are mapped to the AlternativePathConnections table by the parsing software. Ultimately, the user will be able to select desired paths from this table to be implemented in a given utility's network design.

AlternativePathConnections : Table			
	Field Name	Data Type	
?	AlternativePathIndex	AutoNumber	Index for Alternative Path Connections at the Applications Level
	PathSelector	Yes/No	
	App2AppIndex	Number	
	RqmtRef	Text	
	DataFlowRef	Memo	
	ActorA	Text	
	ActorB	Text	
	UseCaseIndex	Number	
	UseCase	Text	
	Requirements	Memo	
	PayloadType	Memo	
	PayloadSizeType	Text	
	DailyClockPeriods	Memo	
	HowOften	Memo	
	Reliability	Memo	
	Latency	Text	
	CandidateNISTLIC	Text	
	PayloadIndex	Number	
	PayloadName	Text	
	PayloadSizeBytes	Text	
	SecurityConfidentiality	Text	
	SecurityIntegrity	Text	
	SecurityAvailability	Text	
▶	Implication	Memo	

AlternativePathParsingReview

This table is provided to support a planned quality control checking process whereby the Requirement Reference for records in the AlternativePathConnections table will be compared to the same parameter in the Application2ApplicationConnections table. The objective is to make sure that each record in the AlternativePathConnections table has been parsed.

AlternativePathParsingReview : Table		
	Field Name	Data Type
🔑	AlternativePathReviewIndex	AutoNumber
	App2AppReqRef	Text
	ParsingComplete	Yes/No

AlternativePathReportData

When a user stores a query generated using the AlternativePathConnections form, the report data is written to this table.

AlternativePathReportData : Table		
	Field Name	Data Type
▶	App2AppIndex	Number
	Project	Text
	Author	Text
	Company	Text
	RqmtRef	Text
	PathSelector	Yes/No
	DataFlowRef	Text
	ActorA	Text
	ActorB	Text
	UseCaseIndex	Number
	UseCase	Text
	Requirements	Memo
	PayloadType	Memo
	PayloadSizeType	Text
	DailyClockPeriods	Memo
	HowOften	Memo
	Reliability	Memo
	Latency	Text
	CandidateNISTLIC	Text
	PayloadIndex	Number
	PayloadName	Text
	PayloadSizeBytes	Text
	SecurityConfidentiality	Text
	SecurityIntegrity	Text
	SecurityAvailability	Text
	Implication	Memo

AltPathExporttoCSV

This table supports the process of generating a CSV file from a user-configured query of the AlternativePathConnections table. When the Export to CSV button is pressed on the form entitled *Alternate Path Application Level Query Analysis* the software writes the results of the query to this table. A separate function is then called that reads the table and generates the CSV file.

AltPathExporttoCSV : Table	
Field Name	Data Type
PathSelector	Yes/No
App2AppIndex	Number
RqmtRef	Text
DataFlowRef	Memo
SourceActor	Text
TargetActor	Text
UseCaseIndex	Number
UseCase	Text
Requirements	Memo
PayloadType	Memo
PayloadSizeType	Text
DailyClockPeriods	Memo
HowOften	Memo
Reliability	Memo
Latency	Text
CandidateNISTLIC	Text
PayloadIndex	Number
PayloadName	Text
PayloadSizeBytes	Text
SecurityConfidentiality	Text
SecurityIntegrity	Text
SecurityAvailability	Text
Implication	Memo

AnnualElectricSalesByState

Application2ApplicationConnections

When Application level (Level 7) connections are made defining the transmission of a given Payload message originated by a Source Actor and delivered to a Target Actor, a parent record will be entered into the System Requirements Spreadsheet, and the Data Flow Reference will be a complex equation that defines multiple alternative routes that the payload can travel across the network. These parent records are mapped to the Application2ApplicationConnections table by the parsing software.

Application2ApplicationConnections : Table		
	Field Name	Data Type
▶	App2AppIndex	AutoNumber
	RqmtRef	Text
	DataFlowRef	Memo
	SourceActor	Memo
	TargetActor	Memo
	UseCaseIndex	Number
	UseCase	Text
	Requirements	Memo
	PayloadType	Memo
	PayloadSizeBytes	Text
	DailyClockPeriods	Memo
	HowOften	Memo
	Reliability	Memo
	Latency	Text
	CandidateNISTLIC	Text
	SecurityConfidentiality	Text
	SecurityIntegrity	Text
	SecurityAvailability	Text
	PayloadIndex	Number
	PayloadName	Text
	PayloadSizeType	Text
	Implication	Memo

Application2ApplicationWithBracketHierarchy


Table holds the Parent Application Level End-To-End Paths that represent logical connections across the network, although the brackets have been organized in accordance with the bracket level in order to facilitate parsing of the data for generation of Alternative Paths for each Parent logical connection.

Application2ApplicationWithBracketHierarchy : Table		
Field Name	Data Type	
App2AppIndex	AutoNumber	
RqmtRef	Text	
DataFlowRef	Text	
SourceActor	Text	
TargetActor	Text	
UseCaseIndex	Number	
UseCase	Text	
Requirements	Memo	
PayloadType	Memo	
PayloadSizeBytes	Text	
DailyClockPeriods	Memo	
HowOften	Memo	
Reliability	Memo	
Latency	Text	
CandidateNISTLIC	Text	
SecurityConfidentiality	Text	
SecurityIntegrity	Text	
SecurityAvailability	Text	
PayloadIndex	Number	
PayloadName	Text	
PayloadSizeType	Text	
Implication	Memo	

ApplicationConnectionsExportToCSV

When the user runs the Application Level Query Analysis form, a button is available on the form labeled **Export to CSV**. Pressing it causes the contents of this table to be erased. It is replaced by the contents of the query in memory. Since the contents are continually erased to make way for the next export, there is no unique index assigned to the record.

A separate routine reads the table and generates the CSV export file.

 ApplicationConnectionsExportToCSV : Table

Field Name	Data Type	
RqmtRef	Text	
DataFlowRef	Text	
SourceActor	Text	
TargetActor	Text	
UseCaseIndex	Number	
UseCase	Text	
Requirements	Memo	
PayloadType	Memo	
PayloadSizeBytes	Text	
DailyClockPeriods	Memo	
HowOften	Memo	
Reliability	Memo	
Latency	Text	
CandidateNISTLIC	Text	
SecurityConfidentiality	Text	
SecurityIntegrity	Text	
SecurityAvailability	Text	
PayloadIndex	Number	
PayloadName	Text	
PayloadSizeType	Text	
Implication	Memo	

ApplicationQueryReportData

When the user runs the Application Level Query Analysis form, a Report button is available on the form. When the Report button is pressed, the contents of this table are erased, and the contents of the query in memory is written to this database table. Since the contents are continually erased to make way for the next report, there is no unique index assigned to the record.

A report linked to the table is run to actually generate the report.

	Field Name	Data Type	
	Project	Text	
	Author	Text	
	Company	Text	
	RqmtRef	Text	
	DataFlowRef	Text	
	SourceActor	Text	
	TargetActor	Text	
	UseCaseIndex	Number	
	UseCase	Text	
	Requirements	Memo	
	PayloadType	Memo	
	PayloadSizeBytes	Text	
	DailyClockPeriods	Memo	
	HowOften	Memo	
	Reliability	Memo	
	Latency	Text	
	CandidateNISTLIC	Text	
	SecurityConfidentiality	Text	
	SecurityIntegrity	Text	
	SecurityAvailability	Text	
	PayloadIndex	Number	
	PayloadName	Text	
	PayloadSizeType	Text	
	Implication	Memo	

AuditData

As a quality check on the input data from the System Requirements Spreadsheet, an audit check was established to examine the small and large brackets used in defining terms. By establishing a level whereby each open bracket adds one to an index, and each closed bracket deducts one from the same index, the index will be zero in a properly formatted mathematical expression. When a non-zero index is encountered, the record is written to this table, and an audit report is generated from the table data.

	Field Name	Data Type
▶	RqmtRef	Text
	DataFlowRef	Memo
	Score	Number
	NetLB	Number
	NetSB	Number

CensusTracts2000

The definition of the gazetteer census tracts from the 2000 census are included in this table.

CensusTracts2000 : Table		
	Field Name	Data Type
▶	CT2KIndex	AutoNumber
	STUSPS	Text
	STATEFIPS	Text
	CountyFIPS	Number
	CTNumber	Text
	Population	Number
	HousingUnits	Number
	LandAreaSqMeters	Number
	WaterAreaSqMeters	Number
	LandAreaSqMiles	Number
	WaterAreaSqMiles	Number
	Latitude	Number
	Longitude	Number

CensusTractTraffic

This is an indexed working table used in the development of the traffic analysis based on Census Tract demographic data.

CensusTractTraffic : Table		
	Field Name	Data Type
▶	ScenarioIndex	Number
	StateCode	Text
	CountyFIPS	Text
	CTCode	Text
	AggregatedCTTraffic	Number

CensusTractTrafficAnalysis

This table contains the traffic from individual Census Tracts at the conclusion of the Traffic Analysis based on demographic data. The table is not indexed, and is cleared and rewritten each time an analysis is run.

CensusTractTrafficAnalysis : Table		
	Field Name	Data Type
▶	CTCode	Text
	CountyName	Text
	StateUSPS	Text
	CTTraffic	Number

CloudCrossings

The cloud crossing table holds the Actor-Actor links that cross any given media or cloud.

CloudCrossings : Table		
	Field Name	Data Type
	CloudCrossingIndex	AutoNumber
	MediaIndex	Number
	DataFlowRef	Text

Counties

This table holds the Gazetteer records from the 2000 Census for every county in the USA.

Counties : Table		
	Field Name	Data Type
	CountiesIndex	AutoNumber
	StateUSPS	Text
	StateFIPS	Text
	CountyFIPS	Number
	CountyName	Memo
	Population	Number
	HousingUnits	Number
	LandAreaSqMeters	Number
	WaterAreaSqMeters	Number
	LandAreaSqMiles	Number
	WaterAreaSqMiles	Number
	Latitude	Number
	Longitude	Number

CountyTraffic

The County Traffic table holds the aggregated traffic in Bytes at the County level from each of the Census Tracts within that county, at the conclusion of each traffic analysis based on demographic data.

CountyTraffic : Table		
	Field Name	Data Type
	ScenarioIndex	Number
	StateCode	Text
	CountyFIPS	Text
	AggregatedCountyTraffic	Number

County Traffic Analysis

This table holds the aggregated traffic in Kbytes along with key demographic characteristics for that county such as Land Area, Housing Units and Population. It is generated at the end of each Traffic analysis based on demographic data, and will support a future report.

CountyTrafficAnalysis : Table		
	Field Name	Data Type
	CountyFIPS	Text
	StateUSPS	Text
	CountyName	Text
	TrafficKBytes	Number
	LandArea	Number
	HousingUnits	Number
	Population	Number

DemographicAnalysis

This table holds extrapolated values for field devices based on scaling factors from EIA-826 and discussions with senior utility industry engineers.

DemographicAnalysis : Table	
Field Name	Data Type
StateCode	Text
CountyFIPS	Text
CTNumber	Text
CTAreaSqMiles	Number
CountyLat	Number
CountyLon	Number
CTLat	Number
CTLon	Number
CTDistMiles	Number
CTAzDeg	Number
NumberResidential	Number
NumberCommercial	Number
NumberIndustrial	Number
TotalEndPoints	Number
TotalKVALoad	Number
NumberFeeders	Number
NumberSubs	Number
NumberSwitches	Number
NumberCapBanks	Number
NumberVR	Number

Documentation_Reference

This table is provided as a vehicle for documenting the current versions of the Excel System Requirements spreadsheet, the Systems Diagram, and the basis for the last update of the Cloud Crossing Table. This table is completely independent, although it is a candidate for automatic updating by a potentially new software package capable of reviewing and documenting changes to the Visio diagram that defines the System Diagram.

Documentation_Reference : Table		
Field Name	Data Type	Description
ExcelDataRelease	Memo	This is the release level assigned to the Excel Spreadsheet Data Input
SystemDiagramRelease	Memo	This is the release level assigned to the System Diagram
CloudCrossingTable	Memo	This is the System Diagram last used to update the Cloud Crossing Table

Domains

This table was originally created to allow the flexibility adding additional domains by SG-Networks if appropriate. As of this writing, the table is still a mirror image of the NIST_Domains table.

Domains : Table	
Field Name	Data Type
DomainIndex	AutoNumber
DomainName	Text

ExcelAppConnectionsImport

This table is used as the starting point for all analysis work done by this tool. The rows from the Excel Spreadsheet holding the System Requirements are pasted into a blank version of this table. The table is not indexed.

	Field Name	Data Type	
	RqmtRef	Text	
	ParentRow	Text	
	DataFlowRef	Memo	
	SourceActor	Text	
	TargetActor	Text	
	UseCase	Text	
	Requirements	Memo	
	Payload_Name	Text	
	PayloadType	Text	
	DailyClockPeriods	Memo	
	HowOften	Memo	
	Reliability	Memo	
	Latency	Text	
	CandidateNISTLIC	Text	
	SecurityConfidentiality	Text	
	SecurityIntegrity	Text	
	SecurityAvailability	Text	
	PayloadSizeType	Text	
	PayloadSizeBytes	Text	
	Implication	Memo	

ExcelPayloadSecurityImport

This file holds the contents of the Payload_attrib_LIC_CIA_rtnl-WIP tab on the System Requirements Spreadsheet. The user will need to open this tab of the spreadsheet, and export the page into a CSV file. That CSV file should be named SGNR.csv and placed into the default directory of [C:\](#). If the user desires another location and/or another file name, a routine called PayloadSecurity() is used to read the CSV file and load the data into this table. That routine is in a module called Payload Security, and the path and filename are easily identified on line 32 of the code in that routine.

	Field Name	Data Type
	PayloadName	Memo
	PayloadType	Memo
	Description	Memo
	Attributes	Memo
	SecurityLIC	Memo
	CIA	Memo
	Comments	Memo

Hourly_Traffic

When the user generates a query using the Network Level Query Analysis form, a traffic analysis of an average twenty-four hour day is generated along with the query, and plotted on a graph located on a tab behind the query form tabular display. The hourly data levels are stored in this table.

Hourly_Traffic : Table		
Field Name	Data Type	
NetConnectionIndex	Number	
ProfileIndex	Number	
RqmtRef	Memo	
BeginHour1	Number	
EndHour1	Number	
BeginHour2	Number	
EndHour2	Number	
PayloadSizeBytes	Number	
LowTimes	Number	
HighTimes	Number	
IndVar1	Number	
IndVar1Desc	Memo	
IndVar2	Number	
IndVar2Desc	Memo	
IndVar3	Number	
IndVar3Desc	Memo	
TimeBase	Number	
Hour0000	Number	
Hour0100	Number	
Hour0200	Number	
Hour0300	Number	
Hour0400	Number	
Hour0500	Number	
Hour0600	Number	
Hour0700	Number	

Hourly_Traffic : Table		
Field Name	Data Type	
Hour0800	Number	
Hour0900	Number	
Hour1000	Number	
Hour1100	Number	
Hour1200	Number	
Hour1300	Number	
Hour1400	Number	
Hour1500	Number	
Hour1600	Number	
Hour1700	Number	
Hour1800	Number	
Hour1900	Number	
Hour2000	Number	
Hour2100	Number	
Hour2200	Number	
Hour2300	Number	

MicrowaveFrequencyBands

This table has been added to support future extensions of propagation studies involving the demographics-based analysis of different regions. With this table, it becomes rather easy to examine alternative forms of backhaul in microwave bands.

Microwave Frequency Bands : Table		
	Field Name	Data Type
	MWFBIndex	AutoNumber
	Description	Text
	LowFrequencyMHz	Number
	HighFrequencyMHz	Number
	TypEIRPdbm	Number
	MaxChannelBWMHz	Number
	TypRXThresholdDbm	Number

NetConExportToCSV

When the user runs the Network Level Query Analysis form, a button is available on the form labeled **Export to CSV**. Pressing it causes the contents of this table to be erased. It is replaced by the contents of the query in memory. Since the contents are continually erased to make way for the next export, there is no unique index assigned to the record.

A separate routine reads the table and generates the CSV export file.

NetConExportToCSV : Table		
	Field Name	Data Type
	RqmtRef	Text
	DataFlowRef	Text
	SourceActor	Text
	TargetActor	Text
	UseCaseIndex	Number
	UseCase	Text
	Requirements	Memo
	PayloadType	Memo
	PayloadSizeBytes	Text
	DailyClockPeriods	Memo
	HowOften	Memo
	Reliability	Memo
	Latency	Text
	CandidateNISTLIC	Text
	SecurityConfidentiality	Text
	SecurityIntegrity	Text
	SecurityAvailability	Text
	PayloadIndex	Number
	PayloadName	Text
	PayloadSizeType	Text
	Implication	Memo

NetworkCrossings

The Network Crossings table currently supports the definition of three User-Selected ways of crossing the network. While multiple alternate ways of connecting any two actors will exist, only one or two of those will ever be built. The Network Crossings table supports the definition of three of these alternatives. In the software, the three alternatives are accessed using a drop-down menu. However, many more columns can be added to the table, and graphical selections can conceptually be utilized in making user selections. The use of MS Access does put some limitations on that process.

NetworkCrossings : Table		
	Field Name	Data Type
	NetCrossingIndex	AutoNumber
	SourceActor	Text
	TargetActor	Text
	DataFlowRef	Text
	DataSelectA	Yes/No
	DataSelectB	Yes/No
	DataSelectC	Yes/No

NetworkQueryReportData

When the user runs the Network Level Query Analysis form, a Report button is available on the form. When the Report button is pressed, the contents of this table are erased, and the contents of the query in memory is written to this database table. Since the contents are continually erased to make way for the next report, there is no unique index assigned to the record.

A report linked to the table is run to actually generate the report.

Field Name	Data Type
Project	Text
Author	Text
Company	Text
RqmtRef	Text
DataFlowRef	Text
SourceActor	Text
TargetActor	Text
UseCaseIndex	Number
UseCase	Text
Requirements	Memo
PayloadType	Memo
PayloadSizeBytes	Text
DailyClockPeriods	Memo
HowOften	Memo
Reliability	Memo
Latency	Text
CandidateNISTLIC	Text
SecurityConfidentiality	Text
SecurityIntegrity	Text
SecurityAvailability	Text
PayloadIndex	Number
PayloadName	Text
PayloadSizeType	Text
Implication	Memo

Network_Connections

This table holds the Actor-Actor connections that make up the Physical Layer of the communications network of the Smart Grid.

Field Name	Data Type
NetConnectIndex	AutoNumber
App2AppIndex	Number
RqmtRef	Text
DataFlowRef	Text
ActorA	Text
ActorB	Text
UseCaseIndex	Number
UseCase	Text
Requirements	Memo
PayloadType	Text
PayloadSizeType	Text
DailyClockPeriods	Memo
HowOften	Memo
Reliability	Memo
Latency	Text
CandidateNISTLIC	Text
PayloadIndex	Number
PayloadName	Text
PayloadSizeBytes	Text
SecurityConfidentiality	Text
SecurityIntegrity	Text
SecurityAvailability	Text
Implication	Memo

NIST_ACTORS

The list of actors originally established by NIST in the Interoperability Standards Roadmap are maintained in this table as an indexed list.

	Field Name	Data Type
🔑	NISTActorIndex	AutoNumber
	ActorDescription	Text
	NISTDomainIndex	Number

NIST_Domains

This table holds an indexed list of the NIST Domains.

	Field Name	Data Type
🔑	NISTDomainIndex	AutoNumber
	NISTDomainName	Text

NIST_LogicalConnections

At the beginning of this work, the connections between NIST Actors were codified and placed in this table as an indexed list.

	Field Name	Data Type
🔑	LogicalConnectorIndex	AutoNumber
	Logical Interface A	Number
	Logical Interface B	Number

Organizations

Within the NIST framework of Domains, the Operations domain was further subdivided by SG-Networks into Operating Organizations. These are kept in this table as an indexed list.

	Field Name	Data Type
🔑	OrganizationIndex	AutoNumber
	Description	Text

Payloads

This table holds an indexed list of the various payloads, each with their size in bytes, provision for a name in plain English, and a payload type index.

Payloads : Table		
	Field Name	Data Type
	PayloadIndex	AutoNumber
	PayloadName	Text
	PayloadSize	Text
	PayloadTypeIndex	Number
	ExpandedPayloadName	Text

PayloadType

This table holds an indexed list of the various types of payloads.

PayloadType : Table		
	Field Name	Data Type
	PayloadTypeIndex	AutoNumber
	PayloadType	Text

Profiles

The content of all given Users Profiles are kept in this working database table.

Profiles : Table			
	Field Name	Data Type	Description
	UtilityIndex	AutoNumber	
	ProfileName	Text	
	UserName	Text	
	UserCompany	Text	
	ServiceAreaSqMiles	Number	Service Area in Square Miles
	NumberDAPS	Number	
	AveNumberDAPSPerSM	Number	
	AveDAP2DAP	Number	
	AveDAPServiceAreaSM	Number	
	AveDAPServiceAreaRadius	Number	
	NumberDAPUpdateEventsPerDay	Number	
	NumberElectricCIMeters	Number	
	NumberSWOperationsPerMeterPerDay	Number	
	NumberElectricResidentialMeters	Number	
	NumberElectricPrePayMeters	Number	
	NumberElectricPrePayMetersWIHD	Number	
	NumberElectricPrePayMetersWCustomerEMS	Number	
	NumberPrePayEnrollments	Number	
	NumberPrePayMeterEnrollmentsPerDay	Number	
	NumberUTCustPremBrowUsersPrePayEnrollPerPremMtr	Number	Number Utility Customer Premise Browser Users PrePay Enroll Per Premise Meter
	NumberUTCustPremBrowUsersPrePayUnEnrollPerPremMtr	Number	Number Utility Customer Premise Browser Users PrePay UnEnroll Per Premise Meter
	NumberREPCustPremBrowUsersPrePayEnrollPerPremMtr	Number	Number REP Customer Premise Browser Users PrePay Enroll Per Premise Meter
	NumberREPCustPremBrowUsersPrePayUnEnrollPerPremMtr	Number	Number REP Customer Premise Browser Users PrePay UnEnroll Per Premise Meter
	NumberPrePayMeterUnEnrollmentsPerDay	Number	
	NumberSWOperationsPerPrePayMeterPerDay	Number	

Profiles : Table		
Field Name	Data Type	
NumberElectricMeters	Number	
AveNumberEMperSM	Number	
AveNumberEMperDAP	Number	
AveEM2EM	Number	
NumberOnDemandCommandsToMetersPerDay	Number	
NumberSmartMetersDeployed	Number	
FirmwareUpgradesPerMonth	Number	
NumberSmartMetersInBulkMsgBatch	Number	
NumberSMartMeterBulkMgBatchesPerDay	Number	
NumberPHEVmetersAccThroughNSMESI	Number	Number PHEV Meters Accessed Through Non-Smart Meter ESI
NumberPHEVmetersAccThroughSMESI	Number	Number PHEV Meters Accessed Through Smart Meter ESI
NumberPHEVmeters	Number	
AveNumPHEVperSM	Number	
AveNumPHEVperDAP	Number	
AvePHEV2PHEV	Number	
NumberPHEVChargingEventsPerDay	Number	
NumberPHEVMeterConnectionsPerDay	Number	
NumberSmartMetersWNIC	Number	
NumberMetersWESI	Number	
NumberMetersThatLosePowerPerDay	Number	
AppErrorEventPerMeterPerDay	Number	
NumberCustomersWCustomerEMS	Number	
NumberCustomersWUtilityEMS	Number	
NumberCustomersWIHD	Number	
NumberDemandResponseCustomers	Number	

Profiles : Table		
Field Name	Data Type	Description
NumberGasCIMeters	Number	
NumberGasResidentialMeters	Number	
TotalNumberGasMeters	Number	
TotalNumberMeters	Number	
NumberDistributionSubstations	Number	
NumberTransmissionSubstations	Number	
NumberTotalSubstations	Number	
AveNumberSUBSPerSM	Number	
AveSUB2SUB	Number	
AveSUBServiceAreaSM	Number	
AveSUBServiceAreaRadius	Number	
NumberFieldDevicesPerDistSubstation	Number	
NumberFieldDevicesPerTransSubstation	Number	
DMSSCADAType	Text	
NumberZoneIsolationSteps	Number	
NScopeFPWCISD	Number	in-scope faulted primary circuit (with tie circuits) isolation switch devices
NumberDistRegulators	Number	
NumberDistCapBanks	Number	
NumberDistFieldSensors	Number	
NumberDistSectionalizers	Number	
NumberDistSwitches	Number	
NumberDistReclosers	Number	
NumberDistCustStorage	Number	
NumberDistCustGeneration	Number	
NumberDistFanGateways	Number	

Profiles : Table		
Field Name	Data Type	Description
NumberDistDAC	Number	
NumberDistRTU	Number	
NumberDistCircuitBreaker	Number	
NumberComWebPortalPrePayMtrs	Number	
NumberUtilityPrePayMeters	Number	
NumberREPPrePayMeters	Number	
NumberDACSubDistrStorUnit	Number	
NumDailyDispatchPerForSSDSU	Number	
NumSSDSUPowerLossEventsPD	Number	
NumLODevicesPerFaultedCkt	Number	
NISFPCID	Number	Number In-scope Faulted Primary Circuit (with tie circuits) Isolation Devices
NISFPCIRD	Number	Number In-scope Faulted Primary Circuit (with tie circuits) Isolation Redoser Devices
NISFPCISWD	Number	Number In-scope Faulted Primary Circuit (with tie circuits) Isolation Switch Devices
NISFPCISECTD	Number	Number In-scope Faulted Primary Circuit (with tie circuits) Isolation Sectionalizer Devices
NumCirReconStepsPerSS	Number	NumberCircuit Reconfiguration Steps Per SubStation
tbNumPrimaryCktWTCBreakers	Number	Number Primary Circuit (with tie circuits) Breakers

ProfileDailyTraffic

This file holds the daily traffic that is calculated when the User Profile is used to scale an Alternative Path query. A recent addition to the table is the calculation of a payload (packet) arrival rate in payloads/hour.

Field Name	Data Type	Description
AltPathIndex	Number	
RqmtRef	Text	
DataFlowRef	Text	
EndPointActor	Text	
UseCase	Text	
DailyClockPeriods	Text	
PayloadName	Text	
PayloadSizeBytes	Text	
HowOften	Text	
NumPerTerms	Number	Extraction of number of "per" terms from the "How Often" column. Helpful in debugging.
BV	Number	Beginning Value
EV	Number	Ending Value
PayloadNumberBytes	Number	Value extracted from parsing
QuantityScale	Number	Sometimes expressed as "Per 1000 meters" or similar
TimeScale	Number	Integer value that establishes original record time scale
TimeFactor	Number	Factor that brings TimeScale basis into a Daily calculation
ActivityScale	Number	Scaling Factor from parsing of "How Often" column, after the second "per" term
CalculatedDailyTraffic	Number	
ArrivalRate	Number	

ProfileHourlyTraffic

This file holds the hourly traffic that is presented in tabular and graphical format when the User Profile is used to scale an Alternative Path query.

Field Name	Data Type
ProfileIndex	Number
RqmtRef	Text
DataFlowRef	Text
BeginHour1	Number
EndHour1	Number
BeginHour2	Number
EndHour2	Number
DailyTrafficBytes	Number
Hour0000	Number
Hour0100	Number
Hour0200	Number
Hour0300	Number
Hour0400	Number
Hour0500	Number
Hour0600	Number
Hour0700	Number
Hour0800	Number
Hour0900	Number
Hour1000	Number
Hour1100	Number
Hour1200	Number
Hour1300	Number
Hour1400	Number
Hour1500	Number
Hour1600	Number
Hour1700	Number

SavedAltPathConnections

When the User runs the Application Level Query Analysis form, using filters for Use Cases, Actors, Payload Names, Payload Types, and Networks or Clouds, the option is available to save these records with an index attached to the Utility/User profile. To accomplish this simply run the query to be saved, then press the button labeled **Save to Current User Profile**.

In a later expansion of the software, it will then be possible for any given user to access all of the stored queries that that user has generated. Since each one has a unique index, in addition to the Utility Index, any number of profiles can be saved by any User/Utility without fear of loss.

SavedAltPathConnections : Table			
	Field Name	Data Type	
?	AlternativePathIndex	AutoNumber	Index for Alternative Path Connections at the Applications Level
	PathSelector	Yes/No	
	App2AppIndex	Number	
	RqmtRef	Text	
	DataFlowRef	Text	
	ActorA	Text	
	ActorB	Text	
	UseCaseIndex	Number	
	UseCase	Text	
	Requirements	Memo	
	PayloadType	Memo	
	PayloadSizeType	Text	
	DailyClockPeriods	Memo	
	HowOften	Memo	
	Reliability	Memo	
	Latency	Text	
	CandidateNISTLIC	Text	
	PayloadIndex	Number	
	PayloadName	Text	
	PayloadSizeBytes	Text	
	SecurityConfidentiality	Text	
	SecurityIntegrity	Text	
	SecurityAvailability	Text	
	Implication	Memo	

SavedScenarios

This table stores the scaling factors that apply to any given scenario as saved by a given user, and is driven by the SpectrumAnalysis form. It includes the results of the initial selection of States and Counties that will be included in any Scenario.

SpectrumScenarios

This table holds only the scaling factors for a given Scenario as established independent of any selections of States and Counties.

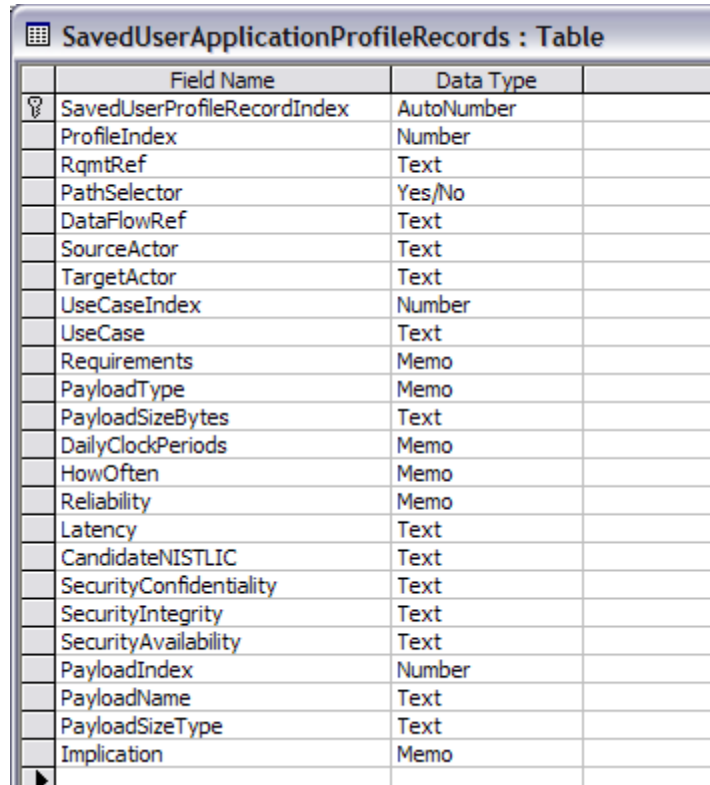
SpectrumScenarios : Table		
	Field Name	Data Type
	SpectrumScenarioIndex	AutoNumber
	UtilityIndex	Number
	ScenarioName	Text
	WirelessPropModelIndex	Number
	BackhaulFreqBandIndex	Number
	NumberFeedersPerSub	Number
	NumberEndPointPerFeeder	Number
	NumberReclosersPerFeeder	Number
	NumberSwitchesPerFeeder	Number
	UncorrectedResPFCT	Number
	UncorrectedCommPFCT	Number
	ObjectivePFCT	Number
	AveCapBankRatingKVA	Number
	RatioCapbanks2VR	Number

SavedScenarios : Table		
	Field Name	Data Type
	SavedScenarioIndex	AutoNumber
	UtilityIndex	Number
	ScenarioIndex	Number
	StateCode	Text
	CountyFIPS	Text
	CTNumber	Text
	CTAreaSqMiles	Number
	CountyLat	Number
	CountyLon	Number
	CTLat	Number
	CTLon	Number
	CTDistMiles	Number
	CTAzDeg	Number
	NumberResidential	Number
	NumberCommercial	Number
	NumberIndustrial	Number
	TotalEndPoints	Number
	TotalKVALoad	Number
	NumberFeeders	Number
	NumberSubs	Number
	NumberSwitches	Number
	NumberCapBanks	Number
	NumberVR	Number

SavedUserApplicationProfileRecords

When the User runs the Application Level Query Analysis form, based using filters for Use Cases, Actors, Payload Names, Payload Types, and Networks or Clouds, the option is available to save these records with an index attached to the Utility/User profile. To accomplish this simply run the query to be saved, then press the button labeled **Save to Current User Profile**.

In a later expansion of the software, it will then be possible for any given user to access all of the stored queries that that user has generated. Since each one has a unique index, in addition to the Utility Index, any number of profiles can be saved by any User/Utility without fear of loss.



	Field Name	Data Type	
🔑	SavedUserProfileRecordIndex	AutoNumber	
	ProfileIndex	Number	
	RqmtRef	Text	
	PathSelector	Yes/No	
	DataFlowRef	Text	
	SourceActor	Text	
	TargetActor	Text	
	UseCaseIndex	Number	
	UseCase	Text	
	Requirements	Memo	
	PayloadType	Memo	
	PayloadSizeBytes	Text	
	DailyClockPeriods	Memo	
	HowOften	Memo	
	Reliability	Memo	
	Latency	Text	
	CandidateNISTLIC	Text	
	SecurityConfidentiality	Text	
	SecurityIntegrity	Text	
	SecurityAvailability	Text	
	PayloadIndex	Number	
	PayloadName	Text	
	PayloadSizeType	Text	
	Implication	Memo	

SavedUserNetworkProfileRecords

When the User runs the Network Level Query Analysis form, based using filters for Use Cases, Actors, Payload Names, Payload Types, and Networks or Clouds, the option is available to save these records with an index attached to the Utility/User profile. To accomplish this simply run the query to be saved, then press the button labeled **Save to Current User Profile**.

In a later expansion of the software, it will then be possible for any given user to access all of the stored queries that that user has generated. Since each one has a unique index, in addition to the Utility Index, any number of profiles can be saved by any User/Utility without fear of loss.

SavedUserNetworkProfileRecords : Table		
Field Name	Data Type	
SavedUserProfileRecordIndex	AutoNumber	
ProfileIndex	Number	
RqmtRef	Text	
DataFlowRef	Text	
SourceActor	Text	
TargetActor	Text	
UseCaseIndex	Number	
UseCase	Text	
Requirements	Memo	
PayloadType	Memo	
PayloadSizeBytes	Text	
DailyClockPeriods	Memo	
HowOften	Memo	
Reliability	Memo	
Latency	Text	
CandidateNISTLIC	Text	
SecurityConfidentiality	Text	
SecurityIntegrity	Text	
SecurityAvailability	Text	
PayloadIndex	Number	
PayloadName	Text	
PayloadSizeType	Text	
Implication	Memo	

States

States : Table			
Field Name	Data Type	Description	
StateIndex	AutoNumber		
StateCode	Text		
StateName	Text		
LandAreaSqMiles	Number		
WaterAreaSqMiles	Number		
TotalAreaSqMiles	Number		
FIPS	Number		
GEO_ID	Text		
GEO_ID2	Number		
NumberPlaces	Number		
AveSeparationOfPlaces	Number	This is based on an allocation of the LandArea into circular areas, allowing separations of 2R	

This table holds the descriptions of each of the states as described in the Census2000 Gazetteer files.

ScenariosDailyTraffic

In this table, the daily traffic is stored for each payload transmission as scaled with demographic data.

ScenariosDailyTraffic : Table		
Field Name	Data Type	Description
AltPathIndex	Number	
RqmtRef	Text	
DataFlowRef	Text	
EndPointActor	Text	
UseCase	Text	
DailyClockPeriods	Text	
PayloadName	Text	
PayloadSizeBytes	Text	
HowOften	Text	
NumPerTerms	Number	Extraction of number of "per" terms from the "How Often" column. Helpful in debugging.
BV	Number	Beginning Value
EV	Number	Ending Value
PayloadNumberBytes	Number	Value extracted from parsing
QuantityScale	Number	Sometimes expressed as "Per 1000 meters" or similar
TimeScale	Number	Integer value that establishes original record time scale
TimeFactor	Number	Factor that brings TimeScale basis into a Daily calculation
ActivityScale	Number	Scaling Factor from parsing of "How Often" column, after the second "per" term
StateCode	Text	
CountyFIPS	Text	
CTCode	Text	
CalculatedDailyTraffic	Number	

Transmission_Media

This table holds an indexed list of the wireless media, both wired and wireless, that can be used for data transport.

Transmission_Media : Table		
Field Name	Data Type	
MediaIndex	AutoNumber	
MediaDescription	Text	

UseCases

This table holds an indexed list of the Use Case names that were analyzed by SG-Networks.

UseCases : Table		
Field Name	Data Type	
UseCaseIndex	AutoNumber	
Description	Text	

UtilityProfileExportToCSV

When the user runs the Utility Profile form, a button is available at the top of the form labeled **Export to CSV**. Pressing it causes the contents of this table to be erased. It is replaced by the contents of the Utility Profile in memory. Since the contents are continually erased to make way for the next export, there is no unique index assigned to the record.

A separate routine reads the table and generates the CSV export file.

UtilityProfileExportToCSV : Table			
Field Name	Data Type	Description	
ProfileName	Text		
UserName	Text		
UserCompany	Text		
ServiceAreaSqMiles	Number		Service Area in Square Miles
NumberDAPS	Number		
AveNumberDAPSPerSM	Number		
AveDAP2DAP	Number		
AveDAPServiceAreaSM	Number		
AveDAPServiceAreaRadius	Number		
NumberDAPUpdateEventsPerDay	Number		
NumberElectricCIMeters	Number		
NumberSWOperationsPerMeterPerDay	Number		
NumberElectricResidentialMeters	Number		
NumberElectricPrePayMeters	Number		
NumberElectricPrePayMetersWIHD	Number		
NumberElectricPrePayMetersWCustomerEMS	Number		
NumberPrePayEnrollments	Number		
NumberPrePayMeterEnrollmentsPerDay	Number		
NumberUTCustPremBrowUsersPrePayEnrollPerPremMtr	Number		Number Utility Customer Premise Browser Users PrePay Enroll Per Premise Meter
NumberUTCustPremBrowUsersPrePayUnEnrollPerPremMtr	Number		Number Utility Customer Premise Browser Users PrePay UnEnroll Per Premise Meter
NumberREPCustPremBrowUsersPrePayEnrollPerPremMtr	Number		Number REP Customer Premise Browser Users PrePay Enroll Per Premise Meter
NumberREPCustPremBrowUsersPrePayUnEnrollPerPremMtr	Number		Number REP Customer Premise Browser Users PrePay UnEnroll Per Premise Meter
NumberPrePayMeterUnEnrollmentsPerDay	Number		
NumberSWOperationsPerPrePayMeterPerDay	Number		

UtilityProfileExportToCSV : Table			
Field Name	Data Type	Description	
NumberGasCIMeters	Number		
NumberGasResidentialMeters	Number		
TotalNumberGasMeters	Number		
TotalNumberMeters	Number		
NumberDistributionSubstations	Number		
NumberTransmissionSubstations	Number		
NumberTotalSubstations	Number		
AveNumberSUBSPerSM	Number		
AveSUB2SUB	Number		
AveSUBServiceAreaSM	Number		
AveSUBServiceAreaRadius	Number		
NumberFieldDevicesPerDistSubstation	Number		
NumberFieldDevicesPerTransSubstation	Number		
DMSSCADAType	Text		
NumberZoneIsolationSteps	Number		
NScopeFPCWTCISD	Number		in-scope faulted primary circuit (with tie circuits) isolation switch devices
NumberDistRegulators	Number		
NumberDistCapBanks	Number		
NumberDistFieldSensors	Number		
NumberDistSectionalizers	Number		
NumberDistSwitches	Number		
NumberDistReclosers	Number		
NumberDistCustStorage	Number		
NumberDistCustGeneration	Number		
NumberDistFanGateways	Number		

UtilityProfileExportToCSV : Table		
Field Name	Data Type	
NumberElectricMeters	Number	
AveNumberEMperSM	Number	
AveNumberEMperDAP	Number	
AveEMZEM	Number	
NumberOnDemandCommandsToMetersPerDay	Number	
NumberSmartMetersDeployed	Number	
FirmwareUpgradesPerMonth	Number	
NumberSmartMetersInBulkMsgBatch	Number	
NumberSmartMeterBulkMsgBatchesPerDay	Number	
NumberPHEVmetersAccThroughNSMESI	Number	Number PHEV Meters Accessed Through Non-Smart Meter ESI
NumberPHEVmetersAccThroughSMESI	Number	Number PHEV Meters Accessed Through Smart Meter ESI
NumberPHEVmeters	Number	
AveNumPHEVperSM	Number	
AveNumPHEVperDAP	Number	
AvePHEVZPHEV	Number	
NumberPHEVChargingEventsPerDay	Number	
NumberPHEVMeterConnectionsPerDay	Number	
NumberSmartMetersWNIC	Number	
NumberMetersWESI	Number	
NumberMetersThatLosePowerPerDay	Number	
AppErrorEventPerMeterPerDay	Number	
NumberCustomersWCustomerEMS	Number	
NumberCustomersWUtilityEMS	Number	
NumberCustomersWIHD	Number	
NumberDemandResponseCustomers	Number	

UtilityProfileExportToCSV : Table		
Field Name	Data Type	Description
NumberDistDAC	Number	
NumberDistRTU	Number	
NumberDistCircuitBreaker	Number	
NumberComWebPortalPrePayMtrs	Number	
NumberUtilityPrePayMeters	Number	
NumberREPPrePayMeters	Number	
NumberDACSubDistStorUnit	Number	
NumDailyDispatchPerForSSDSU	Number	
NumSSDSUPowerLossEventsPD	Number	
NumLODevicesPerFaultedCkt	Number	
NISFPCID	Number	Number In-scope Faulted Primary Circuit (with tie circuits) Isolation Devices
NISFPCIRD	Number	Number In-scope Faulted Primary Circuit (with tie circuits) Isolation Recloser Devices
NISFPCISWD	Number	Number In-scope Faulted Primary Circuit (with tie circuits) Isolation Switch Devices
NISFPCISECTD	Number	Number In-scope Faulted Primary Circuit (with tie circuits) Isolation Sectionalizer Devices
NumCirReconStepsPerSS	Number	Number Circuit Reconfiguration Steps Per SubStation
tbNumPrimaryCktWTCBreakers	Number	Number Primary Circuit (with tie circuits) Breakers

Wireless Frequency Bands

Provision has been made in the program for area coverage analysis using a series of popular parametric propagation models. A key variable for the models and a key issue for Spectrum Allocations is the frequency used. This table is here to support those future studies.

Wireless Frequency Bands : Table		
Field Name	Data Type	
WirelessFBIndex	AutoNumber	
Description	Text	
LowFrequencyMHz	Number	
HighFrequencyMHz	Number	
MaxEIRPdbm	Number	
MaxEIRPDensityDbmPerHz	Number	
MaxChannelBWMHz	Number	
TypicalRXThresholddbm	Number	

UtilityProfileReportData

When the user runs the Utility Profile form, a Report button is available at the top of the form. When the Report button is pressed, the contents of this table are erased, and the contents of the Utility Profile in memory is written to this database table. Since the contents are continually erased to make way for the next report, there is no unique index assigned to the record.

A report linked to the table is run to actually generate the report.

The fields of the table are as follows:

UtilityProfileReportData : Table			
Field Name	Data Type		Description
ProfileName	Text		
UserName	Text		
UserCompany	Text		
ServiceAreaSqMiles	Number		Service Area in Square Miles
NumberDAPS	Number		
AveNumberDAPPerSM	Number		
AveDAP2DAP	Number		
AveDAPServiceAreaSM	Number		
AveDAPServiceAreaRadius	Number		
NumberDAPUpdateEventsPer	Number		
NumberElectricCIMeters	Number		
NumberSWOperationsPerMet	Number		
NumberElectricResidentialMet	Number		
NumberElectricPrePayMeters	Number		
NumberElectricPrePayMeters'	Number		
NumberElectricPrePayMeters'	Number		
NumberPrePayEnrollments	Number		
NumberPrePayMeterEnrollme	Number		
NumberUTCustPremBrowUse	Number		Number Utility Customer Premise Browser Users PrePay Enroll Per Premise Meter
NumberUTCustPremBrowUse	Number		Number Utility Customer Premise Browser Users PrePay UnEnroll Per Premise Meter
NumberREPCustPremBrowUs	Number		Number REP Customer Premise Browser Users PrePay Enroll Per Premise Meter
NumberREPCustPremBrowUs	Number		Number REP Customer Premise Browser Users PrePay UnEnroll Per Premise Meter
NumberPrePayMeterUnEnroll	Number		
NumberSWOperationsPerPre	Number		

UtilityProfileReportData : Table			
Field Name	Data Type		Description
NumberElectricMeters	Number		
AveNumberEMperSM	Number		
AveNumberEMperDAP	Number		
AveEM2EM	Number		
NumberOnDemandCommandsToMetersPerDay	Number		
NumberSmartMetersDeployed	Number		
FirmwareUpgradesPerMonth	Number		
NumberSmartMetersInBulkMsgBatch	Number		
NumberSmartMeterBulkMsgBatchesPerDay	Number		
NumberPHEVmetersAccThroughNSMESI	Number		Number PHEV Meters Accessed Through Non-Smart Meter ESI
NumberPHEVmetersAccThroughSMESI	Number		Number PHEV Meters Accessed Through Smart Meter ESI
NumberPHEVmeters	Number		
AveNumPHEVperSM	Number		
AveNumPHEVperDAP	Number		
AvePHEV2PHEV	Number		
NumberPHEVChargingEventsPerDay	Number		
NumberPHEVMeterConnectionsPerDay	Number		
NumberSmartMetersWNIC	Number		
NumberMetersWESI	Number		
NumberMetersThatLosePowerPerDay	Number		
AppErrorEventPerMeterPerDay	Number		
NumberCustomersWCustomerEMS	Number		
NumberCustomersWUtilityEMS	Number		
NumberCustomersWIHD	Number		

UtilityProfileReportData : Table

Field Name	Data Type	
NumberDemandResponseCustomers	Number	
NumberGasCIMeters	Number	
NumberGasResidentialMeters	Number	
TotalNumberGasMeters	Number	
TotalNumberMeters	Number	
NumberDistributionSubstations	Number	
NumberTransmissionSubstations	Number	
NumberTotalSubstations	Number	
AveNumberSUBSPerSM	Number	
AveSUB2SUB	Number	
AveSUBServiceAreaSM	Number	
AveSUBServiceAreaRadius	Number	
NumberFieldDevicesPerDistSubstation	Number	
NumberFieldDevicesPerTransSubstation	Number	
DMSSCADAType	Text	
NumberZoneIsolationSteps	Number	
NScopeFPCWTCISD	Number	in-scope faulted primary circuit (with tie circuits) isolation switch devices
NumberDistRegulators	Number	
NumberDistCapBanks	Number	
NumberDistFieldSensors	Number	
NumberDistSectionalizers	Number	
NumberDistSwitches	Number	
NumberDistReclosers	Number	
NumberDistCustStorage	Number	
▶ NumberDistCustGeneration	Number	

Appendix C – Modules

A series of modules have been added to the program. These generally include multiple functional routines and provide a wide degree of support for the use of the database and related analyses.

