

SG-Network Smart Grid Requirements Database and Traffic Planning Tool

**Version 5.1
February 27, 2012**

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Preface

During the early efforts to document the business functional and non-functional (volumetric) requirements of the smart grid, with the focus on the telecommunication networks and network traffic, the UCAIug – OpenSG – SG Communications WG – SG Networks Task Force made the observation that the continued use of spreadsheets to effectively perform queries and additional analysis of the requirements data was not be satisfactory, and that a database with the necessary program coding was the preferred target environment. Jerry Armes volunteered to take on the challenge of preparing a database and program code at least suitable for the initial intended use.

Over the course of approximately 16 months, the database and program coding went from the high level concept to the Version release date June 22, 2011. During that time Jerry Armes was employed by Micronet Communications Inc. and they copyrighted that database and program coding work and contributed that to the community for furthering the work efforts.

This database, programming code, and this document was created and maintained by Jerry Armes up to and with the June 22, 2011 release. Jerry Armes' contribution to this work effort is greatly appreciated and valued.

Starting with the June 22, 2011 release, other participants of the SG Network Task Force have proceeded to work on the Microsoft Access 2003™ and Microsoft Access 2010™ database code forks. This includes this update to this document.

Revision History

Version	Revision Date	Revision By	Summary of Changes
V4-d6	'27Jul2010	Jerry Armes	Initial Documentation
	'13Jan/2011	Jerry Armes	Added section on: a) database configuration instructions b) User Profiles c) query forms d) traffic analysis and charting e) increased number of bracket levels f) inclusion of a payloads table g) table field name and data type
	'27Jan2011	Jerry Armes	Minor changes
	'30Jan2011	Jerry Armes	Minor changes

Version	Revision Date	Revision By	Summary of Changes
	'22Jun2012	Jerry Armes	a) added in SG Network Ref Diagram and Requirements Table image graphics b) added the Census Bureau Traffic Modeling sections
5.1	'22Feb2012	Ron Cunningham	a) added sections for preface and revision history b) added description of the database code fork c) updates of text to add clarifications d) updated sections on SG Network Ref Diagram and Requirement Table image graphics e) added step details to Appendix A f) updated Appendix B for table changes per SG Network Requirements Table 5.1 refresh requirements g) updated email address for contacting Micronet Communications

Introduction

This documentation and user manual addresses a Microsoft Access database of Smart Grid Use Case business functional and non-functional requirement 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 SG Requirements data as loaded into the Requirements Database from the Requirements Table. The SG Requirements also contains a variety of alternative communication-path connections that are typically found or anticipated in Smart Grid deployments as illustrated in the SG Networks TF Smart Grid Reference Diagram.

The database was originally conceived as a vehicle for making the SG-Network TF's Use Case data searchable and more usable. At this instant in time, the number of individual requirement records is over 7800 covering 19 Use Cases. One of the objectives of SG-Networks is to continue to document additional Use Case requirements, focused on the telecommunications aspects of Smart Grid deployments

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 SG 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 SG Network TF SG Requirements Table e.g. tables of Actors, Use Cases, Payloads, Payload Types, and other SG Requirements data which gets processed to refresh the Requirements Database tables. 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 Microsoft Visio internal for diagram object attributes 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.

Prior to the 27Apr2011, the database and associate code was based on Microsoft Access 2000™ database and associated Visual Basic for Applications (VBA) language and Active X controls for some charting and grid displays. This platform was convenient initially because many people within SG-Network TF could run and evaluate the software during the development process. Unfortunately, as more of the then current and potential users' office productivity environments got upgraded, fewer people could interact with all the features of the 2000 version. The decision was made to drop support and use of the Active X controls and fork the database and VBA internal coding to both a Microsoft Access 2003™ and 2010™ versions. The Microsoft Access 2000™, VBA, Active X control version is effectively archived as the SG Network TF Requirements Table data is no longer being actively refreshed into that archived version.

The GNU General Public License

Each routine in the software contains the following license statement.

'Copyright (C)Micronet Communications, Inc., 2010, Author: Jerry Armes, company contact (micronet@micronetcom.com)". . This program is free software; you can redistribute it and/or modify it under the terms of the 'GNU General Public License as published by the Free Software Foundation; 'either version 2 of the License, or any later version. This program is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; 'without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. 'See the GNU General Public License for more details. 'You should have received a copy of the GNU General Public License along with this program; if not, write to the Free Software Foundation, Inc., 59 Temple Place, Suite 330, 'Boston, MA 02111-1307 USA

The SG Network SG Requirements Spreadsheet

The the SG Network SG Requirements Table spreadsheet contains 3 tabs (worksheets) that are used in the SG Network SG Requirements Database. Shown here are representative views of those 3 tabs, and no attempt is made to display the most current spreadsheet rendition. The current SG-Network business functional and non-functional volumetric requirements are located at http://osgug.ucaiug.org/UtiliComm/Shared%20Documents/Latest_Release_Deliverables/

"Reqmts-Combined" tab – illustrative example

Reqmt Ref	Reqmt Type (P-Param, C-Config, S-Setup)	Data Flow Ref (min set that includes opt) - SG-Network TF Diag (v.1)	Data Flow from Actor	Data Flow to Actor	Use Case Ref	Requirements (assumed electric unless noted otherwise)	Payload Name - Specific Data/Meta (Logical - info content the same)	Payload Type (cmd, ack, resp-data, comm-err, cmd-err, alarm, alert)	Daily Clock Periods of Primary Occurrence	How Often	Reliability	Latency (response time one-direction) Reqmts	App Payload Size - bytes
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 MDMS shall be able to send bulk meter read information requests to AMI Head-End(s)	bulk_Mtr-read_cmd	cmd	6PM - 6AM	x per UHl per day (batches of y Mtrs)	> 99.5%	< 1 hr	25
MR-005	P	1B	MDMS	AMI Head-End(s)	Meter Reading	MDMS shall be able to send bulk meter read information requests to AMI Head-End(s)	bulk_Mtr-read_cmd	cmd	6PM - 6AM	x per UHl per day (batches of y Mtrs)	> 99.5%	< 1 hr	25
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 AMI Head-End(s) shall be able to process & forward on-demand meter read data to MDMS	bulk_Mtr-read_resp-data	resp-data	6PM - 6AM	x per UHl per day (batches of y Mtrs)	> 99.5%	< 1 hr	xMB
MR-013	P	1B	AMI Head-End(s)	MDMS	Meter Reading	AMI Head-End(s) shall be able to process & forward on-demand meter read data to MDMS	bulk_Mtr-read_resp-data	resp-data	6PM - 6AM	x per UHl per day (batches of y Mtrs)	> 99.5%	< 1 hr	xMB
MR-036	P	1Dg wr (16Ca + 5Ba) wr (16Cb + 5Bb) 1Ca wr (1Cb + 1Cb) wr (1CC + 1Cba)	2-Way Meter - Gas CI	AMI Head-End(s)	Meter Reading	2-Way Meter - Gas CI shall be able to send multi-interval-data meter reads data to AMI Head-End(s)	Mtr-read_multi-interval-data_resp-data	resp-data	24x7	1-6 per GasCI/Mtr per day (may have 15 min vs 1hr interval data)	90% success every 4-6 hr, 98% success over 1 day, > 99.5% over 2 day	< 4 hr (expected window of data delivery)	1600 for 4hr of data - 2400 for 6hr of data
MR-032	C	1Dg	2-Way Meter - Gas CI	DAFpm	Meter Reading	2-Way Meter - Gas CI shall be able to send multi-interval-data meter reads data to DAFpm	Mtr-read_multi-interval-data_resp-data	resp-data	24x7	1-6 per DAFpm-GasCI/Mtr per day (may have 15 min vs 1hr interval data)	90% success every 4-6 hr, 98% success over 1 day, > 99.5% over 2 day	< 4 hr (expected window of data delivery)	1600 for 4hr of data - 2400 for 6hr of data
MR-106	C	16Ca	2-Way Meter - Gas CI	ESI - In Meter	Meter Reading	2-Way Meter - Gas CI shall be able to send multi-interval-data meter reads data to ESI - In Meter	Mtr-read_multi-interval-data_resp-data	resp-data	24x7	1-6 per ESIInMtr-GasCI/Mtr per day (may have 15 min vs 1hr interval data)	90% success every 4-6 hr, 98% success over 1 day, > 99.5% over 2 day	< 4 hr (expected window of data delivery)	1600 for 4hr of data - 2400 for 6hr of data
MR-107	C	5Ba	ESI - In Meter	DAFpm	Meter Reading	ESI - In Meter shall be able to send multi-interval-data meter reads data to DAFpm	Mtr-read_multi-interval-data_resp-data	resp-data	24x7	1-6 per DAFpm-ESIInMtr-GasCI/Mtr per day (may have 15 min vs 1hr interval data)	90% success every 4-6 hr, 98% success over 1 day, > 99.5% over 2 day	< 4 hr (expected window of data delivery)	1600 for 4hr of data - 2400 for 6hr of data
MR-108	C	16Cb	2-Way Meter - Gas CI	ESI - Utility	Meter Reading	2-Way Meter - Gas CI shall be able to send multi-interval-data meter reads data to ESI - Utility	Mtr-read_multi-interval-data_resp-data	resp-data	24x7	1-6 per ESIUtMtr-GasCI/Mtr per day (may have 15 min vs 1hr interval data)	90% success every 4-6 hr, 98% success over 1 day, > 99.5% over 2 day	< 4 hr (expected window of data delivery)	1600 for 4hr of data - 2400 for 6hr of data
MR-109	C	5Bb	ESI - Utility	DAFpm	Meter Reading	ESI - Utility shall be able to send multi-interval-data meter reads data to DAFpm	Mtr-read_multi-interval-data_resp-data	resp-data	24x7	1-6 per DAFpm-ESIUtMtr-GasCI/Mtr per day (may have 15 min vs 1hr interval data)	90% success every 4-6 hr, 98% success over 1 day, > 99.5% over 2 day	< 4 hr (expected window of data delivery)	1600 for 4hr of data - 2400 for 6hr of data
MR-058	C	1Ca	DAFpm	AMI Head-End(s)	Meter Reading	DAFpm shall be able to forward 2-Way Meter - Gas (Commercial/Industrial) multiple-interval-data to AMI Head-End(s)	Mtr-read_multi-interval-data_resp-data	resp-data	24x7	1-6 per DAFpm-GasCI/Mtr per day (may have 15 min vs 1hr interval data)	> 99%	< 10 sec	1600 for 4hr of data - 2400 for 6hr of data
MR-059	C	1Cb	DAFpm	Internet / Extranet gateway(s) - Utility	Meter Reading	DAFpm shall be able to process & forward 2-Way Meter - Gas (Commercial/Industrial) multiple-interval-data as routed through Internet / Extranet gateway(s) - Utility	Mtr-read_multi-interval-data_resp-data	resp-data	24x7	1-6 per DAFpm-GasCI/Mtr per day (may have 15 min vs 1hr interval data)	> 99%	< 10 sec	1600 for 4hr of data - 2400 for 6hr of data
MR-060	C	1Cc	DAFpm	Internet / Extranet gateway(s) - Utility	Meter Reading	DAFpm shall be able to process & forward 2-Way Meter - Gas (Commercial/Industrial) multiple-interval-data as routed through Internet / Extranet gateway(s) - Utility	Mtr-read_multi-interval-data_resp-data	resp-data	24x7	1-6 per DAFpm-GasCI/Mtr per day (may have 15 min vs 1hr interval data)	> 99%	< 10 sec	1600 for 4hr of data - 2400 for 6hr of data
MR-061	C	1Ca	Internet / Extranet gateway(s) - Utility	AMI Head-End(s)	Meter Reading	Internet / Extranet gateway(s) - Utility shall be able to inspect & forward 2-Way Meter - Gas (Commercial/Industrial) multiple-interval-data to AMI Head-End(s)	Mtr-read_multi-interval-data_resp-data	resp-data	24x7	1-6 per GasCI/Mtr per day (may have 15 min vs 1hr interval data)	> 99.5%	< 10 sec	1600 for 4hr of data - 2400 for 6hr of data

"Payload_attrib_LIC_CIA_rtnl" tab – Illustrative Example

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
Audit_Application_Event	alert	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 alert 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;
batt_pwr_notification	alarm	Indication that network or end-point device is running solely on battery power. [this payload only documented for the DAP, as the network and feeder devices with batteries, the corresponding messages is accounted for in the device change of state messages]	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.
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
bulk_Cust_Subset_Acct_Info_Util_data	resp-data	CIS/Billing - Utility sends several large files (batches) of Utility account information to the Utility'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 serious loss of Customer trust and increased frustration with Utility, 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
bulk_Cust_Subset_Acct_Premise_Info_REP_data	resp-data	ODW - REP sends 1 large upload of REP customer account info per day to REP's web portal and optional Common Web Portal for access by the REP's customers	Account ID, Premise ID, Meter ID, Premise Address, billing address, payment history, current billing, general account information (programs enrolled in), energy/demand usage history, for REPs energy customers	7/8	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 serious loss 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
bulk_Cust_Subset_Acct_Premise_Info_Util_data	resp-data	ODW - Utility sends 1 large upload of Utility customer account info per day to Utility's web portal and optional Common Web Portal for access by the Utility's customers	Account ID, Premise ID, Meter ID, Premise Address, billing address, payment history, current billing, general account information (programs enrolled in), energy/demand usage history, for Utility's energy customers	7/8	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 serious loss of Customer trust and increased frustration with Utility, 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

"HowOften-abbrev-xref" tab – Illustrative Example

How_Often abbreviations / terms	Definitions or Actor_Name	comments
Circuit(y)		yth circuit sourced out of Sub(x)
CommonWebPortal	Common Web Portal	jurisdictional or market based
CPP	Critical Peak Pricing	
CustEMS	Cust. EMS	a HAN device
CustMobileBrowser	Cust. Browser - Mobile	
CustPremiseBrowser	Cust. Browser - Premise	
DAPjm	DAPjm	mth DAP of the jth AMI Network technology in the deployment
fdrDCS	Distr. Cust. Storage	xth Distr Cust Storage device, 2 way comm, that typically provides service to 4-6 residential sized customers
DLC	Direct Load Control	a HAN device
DRDLC	Demand Response Direct Load Control	
ElectrC/IMtr	2-Way Meter - Electr C/I	Commercial or Industrial rated meter
ElectrMtr	2-Way Meter - Electr	all types of electric meters
ElectrResdIMtr	2-Way Meter - Electr Resdnt	residential grade meter
ESI	ESI - In Meter, ESI - Utility, ESI - 3rd Party	any of the ESI modeule types in the deployment

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

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

UTILITY

Project: MICRONET-1
 Author: Jerry Armes
 Company: Micronet
 Utility Service Area (Square Miles): 9286

ELECTRIC METERS

Total Number Electric Meters: 2250000
 Average Number Electric Meters Per Square Mile: 242.3
 Average Meter to Meter Separation Distance (Miles): .1
 Average Coverage Area (Square Feet) Per Meter: .004
 Average Radius (Miles) of Each Meter Coverage Area: .1

GAS METERS

Number C/I Gas Meters: 4000
 Number Residential Gas Meters: 4900
 Total Number Gas Meters: 12000

TOTAL METERS

Total Number Meters: 2262000

SYSTEM PARAMETERS

Number Firmware Upgrades Per Month: 5
 Number DAP Update Events Per Day: 6800

SUBSTATIONS

Total Number Substations: 1200
 Average Number Substations Per Square Mile: .1
 Average Substation to Substation Separation Distance (Miles): 6.3
 Average Coverage Area Per Substation (Square Miles): 7.7
 Average Substation Service Area Radius (Miles): 3.1

DATA AGGREGATION POINTS (DAPS)

Total Number DAPS: 300
 Average Number Meters Per DAP: 7540.0
 Average Number DAPS Per Square Mile: .032
 Average Coverage Area Per DAP (Square Miles): 31.0
 Average Radius (Miles) of Each DAP Coverage Area: 6.3
 Average Distance (Miles) Between DAP Locations: 12.6

PHEV

Total Number PHEV: 3000
 Average Number PHEV Per Square Mile: .3
 Average PHEV Coverage Area: 3.1
 Average Distance Between PHEV Locations (Miles): .7
 Average Number PHEV per DAP: 10.0

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.

Record: 14 | 1 | of 1

UtilityProfile : Form

MICRONET-1 Export to CSV Report Save to Utility Profile

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

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.

Record: 14 | 1 | of 1

UtilityProfile : Form

MICRONET-1 Export to CSV Report Save to Utility Profile

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

ELECTRIC METERS

Number Smart Meters	22500000
Number Smart Meters With NIC	15000000
Number Smart Meters With ESI	200
Number of Electric C/I Meters	4000
Number of Residential Electric Meters	20000
Total Number Electric Meters	22500000
Number PHEV Meters	3000
Number PrePay Meters With IHD	2500
Number PrePay Meters With Customer EMS	3000
Number PrePay Enrollments	500
Number PrePay Enrollments Per Day	15000
Number PrePay UnEnrollments Per Day	5000
Number PHEV Meter Connections Per Day	3400
Number PrePay Meters	5000

GAS METERS

Number Gas C/I Meters	4000
Number Gas Residential Meters	4900

SYSTEM PARAMETERS

Number Meters That Lose Power Per Day	100
Number PHEV Meters Accessed Through ESI Non-Smart Meter	24000
Number PHEV Meters Accessed Through Smart Meter ESI	6000
Number Utility Customer Premise Browser Users PrePay Enrollment Per Premise Meter	2500
Number Utility Customer Premise Browser Users PrePay UnEnrollment Per Premise Meter	7000
Number REP Customer Premise Browser Users PrePay Enrollment Per Premise Meter	8000
Number REP Customer Premise Browser Users PrePay UnEnrollment Per Premise Meter	4000
Application Error Event Per Meter Per Day	5
Number Switch Operations Per Meter Per Day	10000
Number Switch Operations Per PrePay Meter Per Day	2800
Number On-Demand Commands Per Meter Per Day	1000
Number of Smart Meter Bulk Message Batches Per Day	2500
Number of Smart Meters In Each Bulk Message Batch	25000
Number Common Web Portal PrePay Meters	7000
Number Utility PrePay Meters	500000
Number REP PrePay Meters	7000

Record: 1 of 1

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.

UtilityProfile : Form

MICRONET-1 Export to CSV Report Save to Utility Profile

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

SUBSTATIONS

Number Distribution Substations	1000
Number Transmission Substations	200
Total Number Substations	1200

FIELD DEVICES

Number Distribution Field Area Network (FAN) Gateways	500
Number Distribution Regulators	500
Number Capacitor Banks	500
Number Distribution Field Sensors	500
Number Distribution Sectionalizers	750
Number Distribution Switches	500
Number Distribution Redosers	500
Number Distribution Customer Storage Units	500
Number Distribution Customer Generation Units	500
Number Distribution DAC	500
Number Distribution SCADA RTU	500
Number Distribution Circuit Breakers	500

SYSTEM PARAMETERS -FCIR MESSAGING

Number Field Devices Per Distribution Substation	5750
Number Field Devices Per Transmission Substation	3000
Number DAC SubStation Distribution Storage Units	10000
Number of Daily Dispatch Periods for SubStation Distributed Storage Units	2600
Number of Substation Distributed Storage Unit Power Loss Events Per Day	2000
Number Locked Out Devices Per Faulted Circuit	100
Number Locked Out Redoser Devices Per Faulted Circuit	3000
Number In-scope Faulted Primary Circuit (with tie circuits) Reconfig Switch Devices	240
Number In-scope Faulted Primary Circuit (with tie circuits) Isolation Devices	3000
Number In-scope Faulted Primary Circuit (with tie circuits) Isolation Redoser Devices	3000
Number In-scope Faulted Primary Circuit (with tie circuits) Isolation Switch Devices	3000
Number In-scope Faulted Primary Circuit (with tie circuits) Isolation Sectionalizer Devices	3000
Number Circuit Reconfiguration Steps Per SubStation	3000
Number Primary Circuit (with tie circuits) Breakers	3000
Number Zone Isolation Steps Per SubStation Per Day	3
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

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.

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. At the top, the 'User Profiles' dropdown is set to 'MICRONET-1'. Below it, the 'Use Case Records' table is visible, listing various use cases and their requirements. The table has the following columns: RqmtRef, DataFlowRef, Source Actor, Target Actor, Use Case, and Requirements. The 'cmd' payload type is selected in the 'Payload Types' filter panel.

RqmtRef	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 i
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 upi
FPU-099	[1Ca or (1Cba +	AMI Head-End	2-Way Meter	Firmware / Program	AMI Head-End may be able to process & send metrology program upi
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.

The screenshot shows the 'Network Query Analysis' application interface. At the top, the 'User Profiles' dropdown is set to 'MICRONET-1'. Below it, the 'Use Case Records' table is displayed with the following columns: RqmtRef, DataFlowRef, Source Actor, Target Actor, Use Case, and Requirements. The table contains 18 rows of data. Below the table, there are three dropdown menus: 'Payload Name', 'Payload Types', and 'Networks/Clouds'. On the right side, there are four buttons: 'Run Query', 'Save to Current User Profile', 'Generate Report', and 'Export to CSV'.

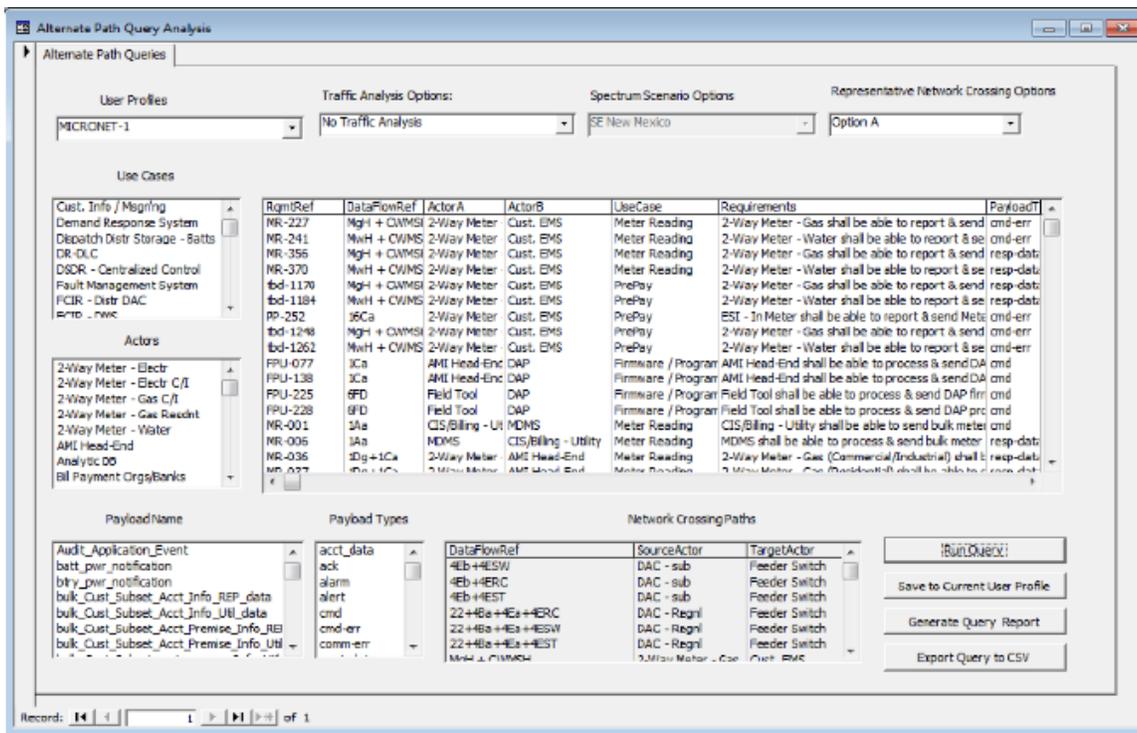
RqmtRef	DataFlowRef	Source Actor	Target Actor	Use Case	Requirements
FCIR-S-0	4ERC	Feeder Recloser	FAN gateway - sub	FCIR - Distr DAC	Feeder Recloser shall be able to send fault lock out alarm to FAN gateway - sub
FCIR-S-0	4Eb	FAN gateway - sub	DAC - sub	FCIR - Distr DAC	FAN gateway shall be able to process & forward fault lock out alarm to DAC - sub
FCIR-S-0	4ECR	Circuit Breaker	RTU	FCIR - Distr DAC	Circuit Breaker shall be able to send fault lock out alarm to RTU
FCIR-S-0	4ERU	RTU	DAC - sub	FCIR - Distr DAC	RTU shall be able to process + forward fault lock out alarm to DAC - sub
FCIR-S-0	4Ca	DAC - sub	Distr SCADA FEP	FCIR - Distr DAC	DAC - sub shall be able to process & forward fault lock out alarm to Distr SCADA FEP
FCIR-S-0	4A	Distr SCADA FEP	DMS	FCIR - Distr DAC	Distr SCADA FEP shall be able to process & forward fault lock out alarm to DMS
FCIR-S-0	26	Distr SCADA FEP	DMS	FCIR - Distr DAC	Distr SCADA FEP may be able to process & forward fault lock out alarm to DMS
FCIR-S-0	25	Distr SCADA FEP	Analytic DB	FCIR - Distr DAC	Distr SCADA FEP may be able to process & forward fault lock out alarm to Analytic DB
FCIR-S-0	20	DMS	DMS	FCIR - Distr DAC	DMS may be able to process & send fault lock out alarm to DMS
FCIR-S-0	24	DMS	Analytic DB	FCIR - Distr DAC	DMS may be able to process & send fault lock out alarm to Analytic DB
FCIR-S-0	4Eb	DAC - sub	FAN gateway - sub	FCIR - Distr DAC	DAC - sub shall be able to process & send device status request to FAN gateway - sub
FCIR-S-0	4ERC	FAN gateway - sub	Feeder Recloser	FCIR - Distr DAC	FAN gateway - sub shall be able to process & forward device status request to Feeder Recloser
FCIR-S-0	4ESw	FAN gateway - sub	Feeder Switch	FCIR - Distr DAC	FAN gateway - sub shall be able to process & forward device status request to Feeder Switch
FCIR-S-0	4EST	FAN gateway - sub	Sectionalizer	FCIR - Distr DAC	FAN gateway - sub shall be able to process & forward device status request to Sectionalizer
FCIR-S-0	4ERU	DAC - sub	RTU	FCIR - Distr DAC	DAC - sub shall be able to process + forward device status request to RTU
FCIR-S-0	4ECR	RTU	Circuit Breaker	FCIR - Distr DAC	RTU shall be able to send device status request to Circuit Breaker

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.

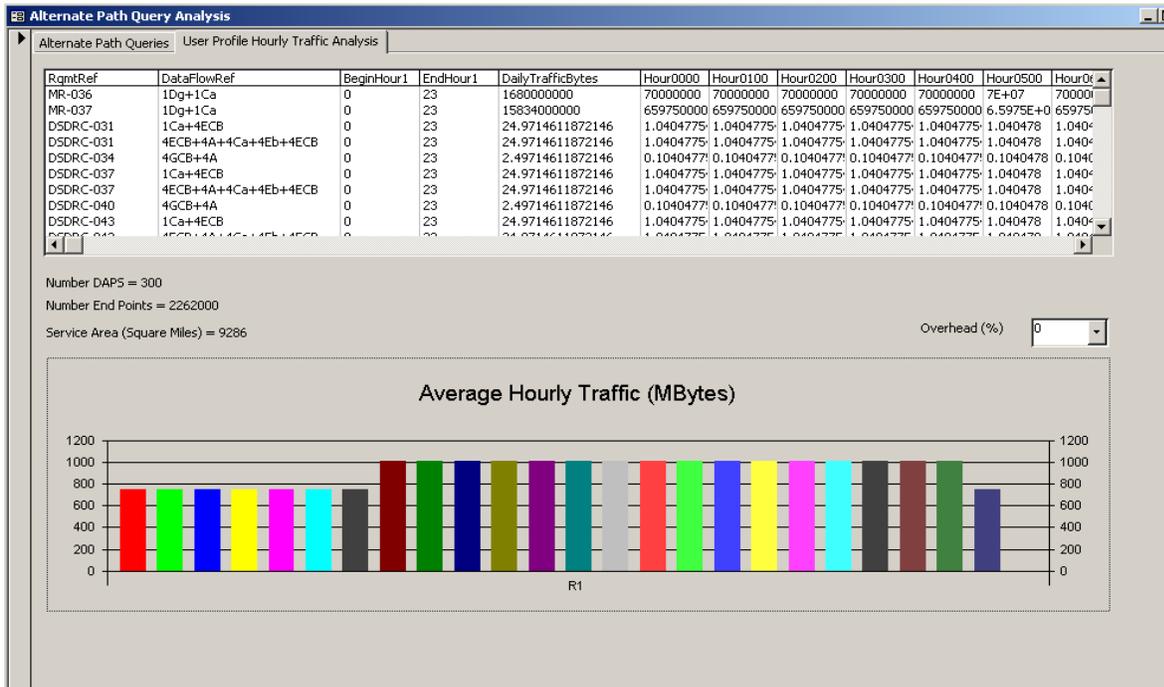


The second is the query scaled by the User Profile. That is shown in the following graphics.

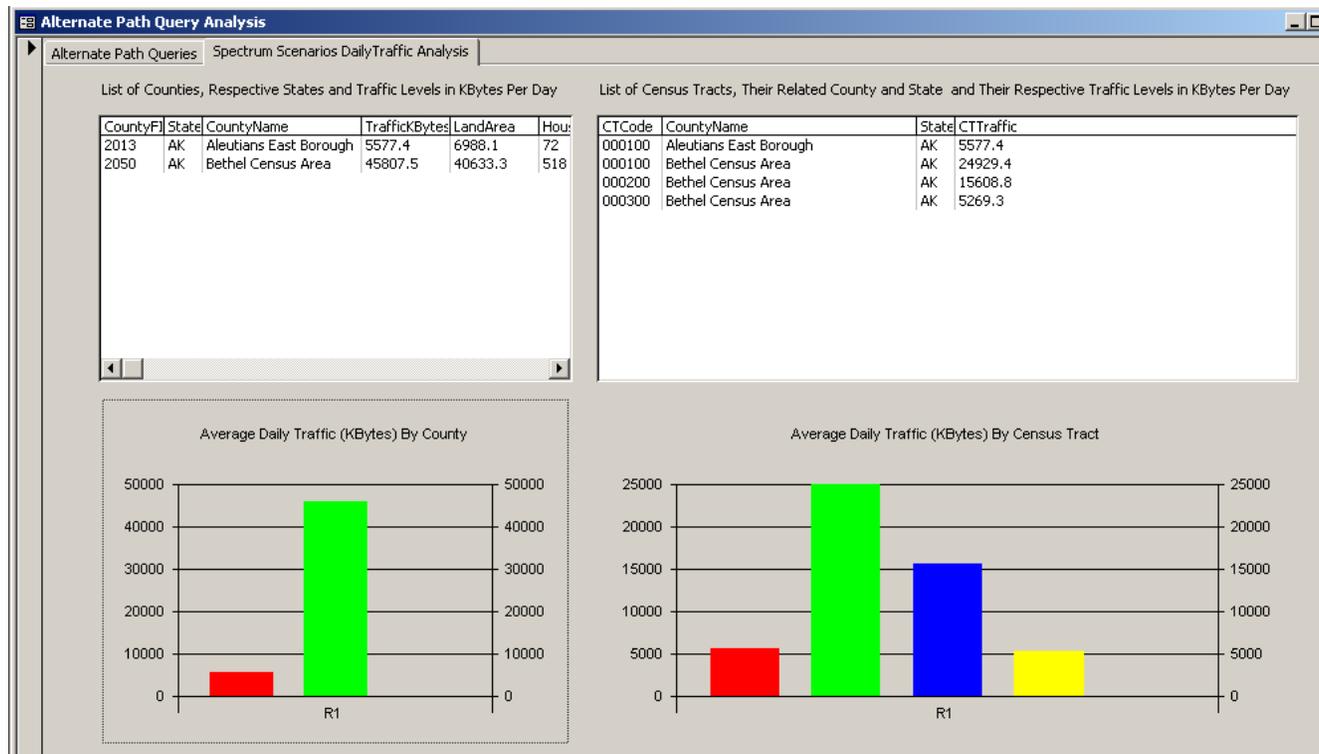
The screenshot shows the 'Alternate Path Query Analysis' application window. It has a title bar and a menu bar. The main area is divided into several sections:

- User Profiles:** A dropdown menu showing 'MICRONET-1'.
- Traffic Analysis Options:** A dropdown menu showing 'Use User Profile Variables'.
- Spectrum Scenario Options:** A dropdown menu showing 'Option A'.
- Representative Network Crossing Options:** A dropdown menu showing 'Option A'.
- Use Cases:** A list of use cases including 'Cust. Info / Msg'ng', 'Demand Response System', 'Dispatch Distr Storage - Batts', 'DR-DLC', 'DSDR - Centralized Control', 'Fault Management System', 'FCIR - Distr DAC', and 'FTRD - RMS'.
- Actors:** A list of actors including '2-Way Meter - Electr', '2-Way Meter - Electr C/I', '2-Way Meter - Gas C/I', '2-Way Meter - Gas Resndt', '2-Way Meter - Water', 'AMI Head-End', 'Analytic DB', and 'Bill Payment Orgs/Banks'.
- Table:** A table with columns: RqmtRef, DataFlowRef, ActorA, ActorB, UseCase, Requirements, and Payload. It contains multiple rows of data.
- Payload Name:** A list of payload names including 'Audit_Application_Event', 'batt_pwr_notification', 'btry_pwr_notification', 'bulk_Cust_Subset_Acct_Info_REP_data', 'bulk_Cust_Subset_Acct_Info_Util_data', 'bulk_Cust_Subset_Acct_Premise_Info_REI', and 'bulk_Cust_Subset_Acct_Premise_Info_Util'.
- Payload Types:** A list of payload types including 'acct_data', 'ack', 'alarm', 'alert', 'cmd', 'cmd-err', and 'comm-err'.
- Network Crossing Paths:** A table with columns: DataFlowRef, SourceActor, and TargetActor. It contains multiple rows of data.
- Buttons:** 'Run Query', 'Save to Current User Profile', 'Generate Query Report', and 'Export Query to CSV'.
- Record:** A status bar showing 'Record: 1 of 1'.

This graphic is an example of the charting capability contained in the Microsoft Access 2000™ database code version



The third is the use of demographic data and the Spectrum Scenario parameters. The example below illustrates the charting capability in the Microsoft Access 2000™ database code version and reflects counties in Alaska.



Arrival Rate Calculations

Arrival Rate calculations have been provided in the program to support future queuing 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	2000	1680000000	35000
MR-037	Meter Reading	24x7	2000	15834000000	329875
DSDRC-031	DSDR - Centralized Control	From 1-6 hrs dratba , fro	250	24.9714611872146	0.0041619101978691
DSDRC-031	DSDR - Centralized Control	From 1-6 hrs dratba , fro	250	24.9714611872146	0.0041619101978691
DSDRC-034	DSDR - Centralized Control	From 1-6 hrs dratba , fro	25	2.49714611872146	0.0041619101978691
DSDRC-037	DSDR - Centralized Control	From 1-6 hrs dratba , fro	250	24.9714611872146	0.0041619101978691
DSDRC-037	DSDR - Centralized Control	From 1-6 hrs dratba , fro	250	24.9714611872146	0.0041619101978691
DSDRC-040	DSDR - Centralized Control	From 1-6 hrs dratba , fro	25	2.49714611872146	0.0041619101978691
DSDRC-043	DSDR - Centralized Control	From 1-6 hrs dratba , fro	500	24.9714611872146	0.00208095509893455
DSDRC-043	DSDR - Centralized Control	From 1-6 hrs dratba , fro	500	24.9714611872146	0.00208095509893455
DSDRC-046	DSDR - Centralized Control	From 1-6 hrs dratba , fro	25	1.24857305936073	0.00208095509893455
DSDRC-055	DSDR - Centralized Control	From 1-6 hrs dratba , fro	500	24.9714611872146	0.00208095509893455
DSDRC-058	DSDR - Centralized Control	From 1-6 hrs dratba , fro	25	1.24857305936073	0.00208095509893455
DSDRC-067	DSDR - Centralized Control	From 1-6 hrs dratba , fro	250	149.828767123288	0.0249714611872146
DSDRC-073	DSDR - Centralized Control	From 1-6 hrs dratba , 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 example 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 below. 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 dropdown menus for "MICRONET-2", "3650 - 3700", and "Spectrum Scenario Options".
- Propagation Model Selection:** Includes dropdown menus for "Flat" and "Lower 6 GHz".
- Backhaul Frequency Band Selection:** Includes a dropdown menu.
- Buttons:** "Report", "Export to CSV", and "Save Spectrum Scaling Parameters".
- Scenario Information:** Text input fields for "Scenario", "Project" (MICRONET-1), "Author" (Jerry Ames), and "Company" (Micronet).
- Parameter List:** A table of numerical parameters with input fields:

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

At the bottom, there is a record navigation bar showing "Record: 1 of 7" and a search field.

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 counter-intuitive 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.

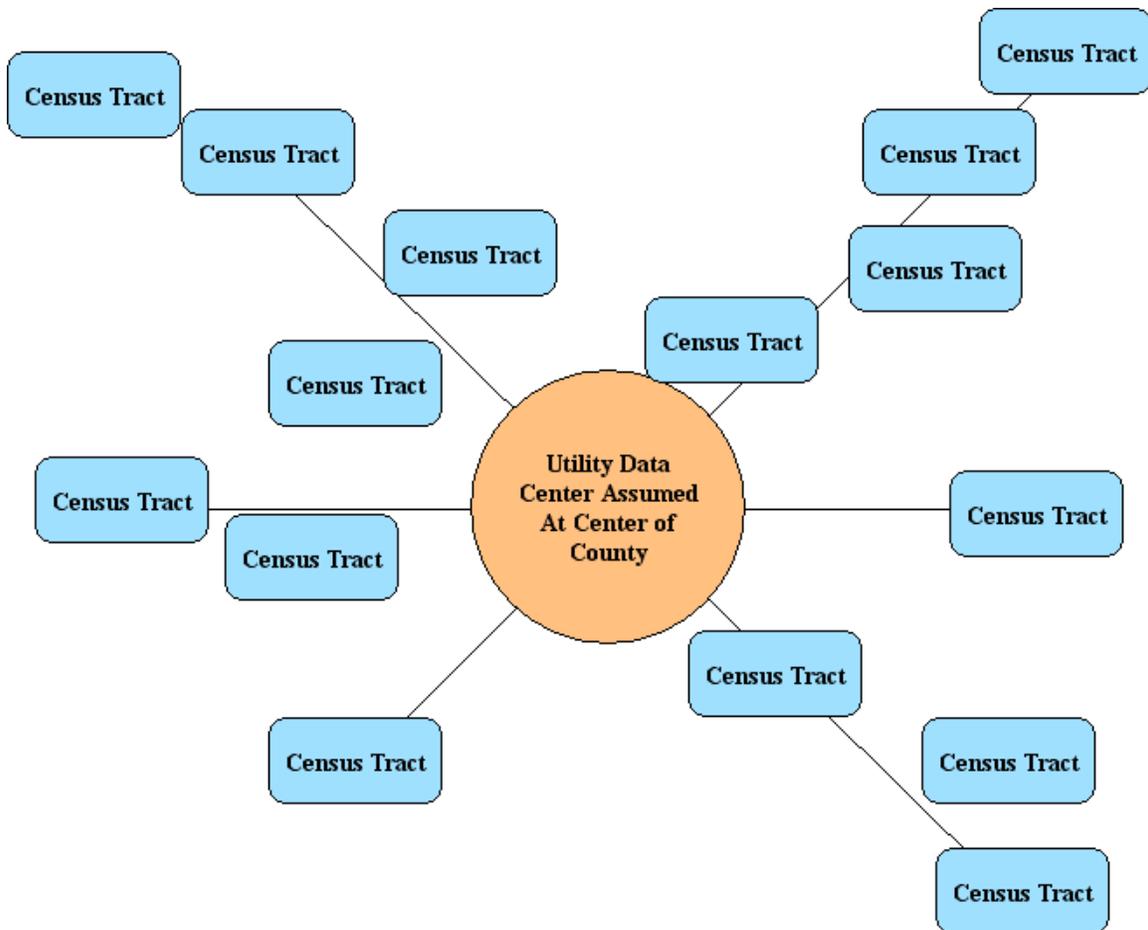
¹ <http://www.census.gov/geo/www/2010census/>

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

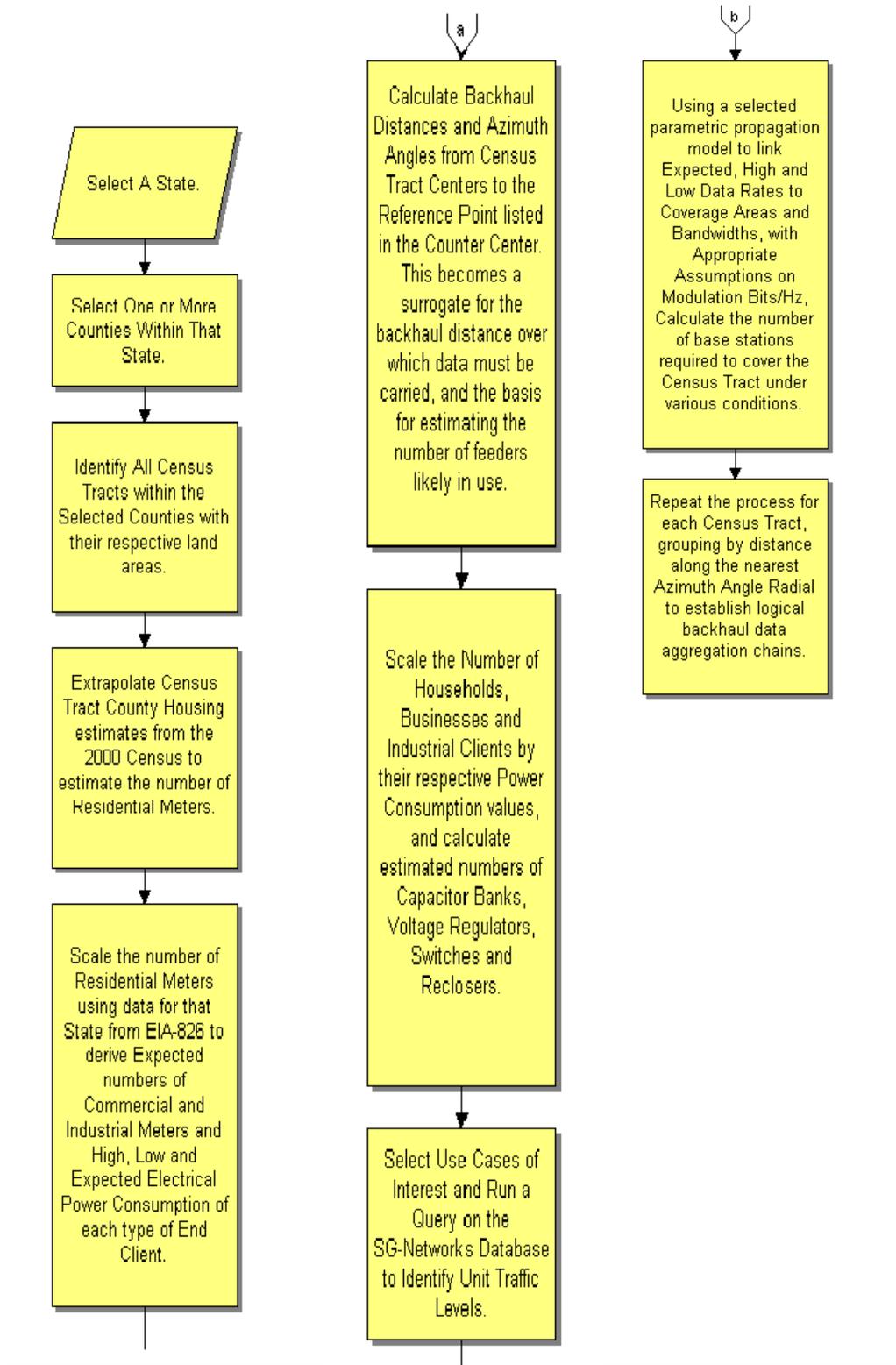
The Census Tract Data

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 Refresh and Parsing Documentation

There are several steps that need to be performed to refresh the database with updated data from the SG Network TF Requirements Table and parse this data into the appropriate database tables. A number of tables and related software routines have been developed to support this effort. The following steps specifically geared to loading the "SG Network System Requirements Specification v5.1.xls" primary contents into the Requirements Database and saving as "SGNet-2012mod-5.1.mdb" using the Microsoft Access 2003™ and included VBA fork of the database. These steps would be comparable to that used on the Microsoft Access 2010™ database version.

Steps to Refresh the Requirements Database Tables from the Requirements Table Tabs:

- 1) Extract SGNet-2010mod-5.0.mdb from SGNet-2010mod-5.0.zip and rename the .mdb to "SGNet-2012mod-5.1.mdb" then remove the security block on the file to allow Microsoft Access 2003 or 2010 to open it.

- 2) Clear out the following database tables:
 - **AlternativePathConnections**
 - **Application2ApplicationConnections**
 - **Application2ApplicationWithBracketHierarchy**
 - **Network_Connections**
 - **ExcelAppConnectionsImport**
 - **ExcelPayloadSecurityImport**
 - **Payloads (but add back a dummy record that will be deleted later)**
 - **AuditData**
 - **HowOften_AbbrevTerms**

Note: When deleting the contents of an indexed table, it is absolutely true that the table will start at the next index when reloaded. This can be avoided by deleting the index, saving the table, then reopening and reinserting the index and setting the key. If the table has a relationship, that has to be disconnected first then reconnected. This process maybe more trouble than it is worth.

- 3) Determine if any of the Requirements Table spreadsheet cell sizes have increased in the “Reqmts-Combined” and “Payload_attrib_LIC_CIA_rtnl” tabs as compared the the values in the following table. If necessary, update this table for a value that satisfies the data content needs. The field sizes used to sync across the tables for the “SGNet-2012mod-5.1.mdb” are:

Max size via excel len()	Requirement Table field name	database field type	database field size
10	Rqmt Ref	Text	15
1	Row Type	Text	5
455	Data Flow Ref	Memo	
191	From Actor	Text	255
191	To Actor	Text	255
36	Use Case	Text	50
321	Requirements	Memo	
44	Payload Name	Text	50
10	Payload Type	Text	15
64	Daily Clock	Text	100
158	How Often	Text	255
74	Reliability	Text	100
41	Latency	Text	50
16	Payload Size Type	Text	25
87	Payload Size	Text	100
365	Description	Memo	
213	Attributes	Text	255
14	LIC	Text	25
5	CIA	Text	10
1029	Rationale	memo	

- 4) If any field type/size changes are noted in step (3), then consistently update the database tables fields type and size per the step (3) table values, across all of the database tables, especially those identified in step (2).
- 5) Open the **Documentation_Reference** table and update the Excel-Data-Release and System Diagram Reference Fields.
- 6) Copy/paste the clean version of the “SG Network System Requirements Specification v5.1.xls” file's “Reqmts-Combined” tab (less the heading row, and make sure to unhide any columns e.g. column “N”), into the **ExcelAppConnectionsImport** table. Hint, remember to highlight the lone insert row in the target table for the copy/paste operation. 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.

- 7) Upon successful completion of step 6, it is necessary to scan this table for Null Fields as there will be empty cells in the SG Network SG Requirements Table spreadsheet file. Running the Module named **ScanForNull**, examines each field in the **ExcelAppConnectionsImport** table and inserts "tbd" into any Null fields. Open the Module labeled **ScanForNull**, locate the subroutine labeled as "Private Sub NullScanner()", place the cursor inside this routine, and run it from the little Horizontal Arrow on the Toolbar.
- 8) Copy/paste clean version of "**Payload_attrib_LIC_CIA_rtnl**" tab into the **ExcelPayloadSecurityImport** table. Note: an alternative method is to use the **PayloadSecurity** module that can read a CSV file generated from this particular tab on the spreadsheet. It can be used provided:
 - that your CSV export allows you to specify ":" as the column separator. As a precaution, the SG Network TF Documenting Requirements Instructions for that Requirements Table tab specifically restrict the use of ":" in the payload tab text, for this alternative.
 - saved file is "**SGNR.csv**" located at root of C drive
- 9) Open the **HowOften_AbbrevTerms** table and copy/paste the content of "**HowOften-abbrev-xref**" into the this table.
- 10) Open the **UseCases** table and update it to match the Use Case names as listed in the "**payload-usecase-row-cnt**" tab of the Requirements Table.
- 11) The **PayloadTableUpdating** module is used 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. Open the **PayloadTableUpdating** module and locate the "Private Sub PayLoadAnalysis()" routine. Place the cursor down inside this routine, then run it from the little Horizontal Arrow on the Toolbar. It takes a few moments.
- 12) Open the **Payloads** table and remove that dummy record inserted in step 2g. **The current PayloadTableUpdating module does not populate the correct payload size into the Payloads table records. That routine needs to be corrected.**
- 13) 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 (Data Flow Ref pseudo code), from the SG Network SG Requirements Table spreadsheet file are maintained. Open the **TableMapper** module and find the "Private Sub TableMapper()" routine. Place the cursor down inside

this routine, then run it from the little Horizontal Arrow on the Toolbar.

- o At this point in the process, check the row count in the **Application2ApplicationConnections** table, this should equal the number of parent rows in the Requirements Table, e.g. for 5.1 that is 500 parent rows. The **Network_Connections** table now contains 7374 records. So 500 parent rows plus 7354 child rows = 7854 rows which matches the **ExcelAppConnectionsImport** table row count.

- 14) Locate the **Audit** Module, and the "Private Sub DFR Audit()". Place the cursor inside this routine and run it. You may be prompted to review the output printer, which was done and a clean bracket imbalance report was shown. This is good. Any errors will also be identified in the **AuditData** table. **Note: there is a Use Case Audit routine, but it is actually misnamed and is not documented in these instructions yet.**
- 15) . 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**. Open the **TableMapperWHierarchy** and step into the subroutine "Private Sub TableMapperWithBracketHierarchy()". After placing the cursor inside this routine, run it from the arrow on the Toolbar.
- 16) Open the **Application2ApplicationWithBracketHierarchy** table and the record count should match the **Application2ApplicationConnections** table, and it should also match the parent records found in **ExcelAppConnectionsImport** table e.g. for Requirements Table 5.1 records.
- 17) To ensure data consistency across various authors, a routine named **ReBracket** is used to standardize the brackets for various levels in accordance with table below. Open the **ReBracket** Module, place the cursor inside the "Private Sub ReBracket()" routine and run it from the Arrow on the Toolbar

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

Steps for Parsing the SG Requirements Data for Alternative Communication Paths

- 18) Since the SG Requirements Table parent rows describing the Actor to actor communication path alternatives (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.
- ⤴ 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) and (&) statements must be carefully logged.
 - ⤴ Construction of the individual alternative routes and mapping of them to the **AlternativePathConnections** table.

Open the **DFR_Parser** Module. Locate the the, "Private Sub Extended_DFR_Parsing()", this is the the one to use.

- Near the top of the routine are two records that read as follows:
 - The record "Set rstAlternateConnections = curDatabase.OpenRecordset("AlternativePathConnections)" if this record's text is black text, then this is the normal use mode, no change is required. The output goes to the **AlternativePathConnections** table.
 - The other record, "Set rstAlternateConnections = curDatabase.OpenRecordset("ParsingTestTable)" is used if needing to test this routine and alter the normal routing of output. To do this, remove the "" mark at the beginning of the record, and place that symbol at the beginning of the record in (i) above.
 - The Parsing Test Table is used for test and checkout. The DFR routine is routing the output to the Parsing Test Table rather than to the **AlternativePathConnections** Table.
- Run this routine from the Arrow on the Toolbar
- There is a subtlety here. When **Table Mapper** was run per Requirements Table 5.1 input (step 13), it found 30 child records that their From & To actors matched exactly with their parents' From & To actors, and are deemed valid rows for **AlternativePathConnections** table. Since there was no need to parse these, they were added to the **AlternativePathConnections** table at that time. But if you blank out this table for any reason, it will also be necessary to also blank out the **Application2ApplicationConnections** and **Network_Connections** table and rerun **TableMapper**.
- The "Private Sub Extended_DFR_Parsing()" routine, contains the cases where the parsing code is missing (not complete). Those cases are commented out e.g. ""

in front of each of these. Once the case coding is completed and tested, then the "" symbols can be removed for normal processing. Run the program from the Arrow on the Toolbar.

- At the end of the process, the **AlternativePathConnections** table had a total of 2255 records per the Requirements Table 5.1 input and current state of DFR_Parsing routine.
- **Since all of the parsing code is not yet complete, there are still some records to to be processed.**

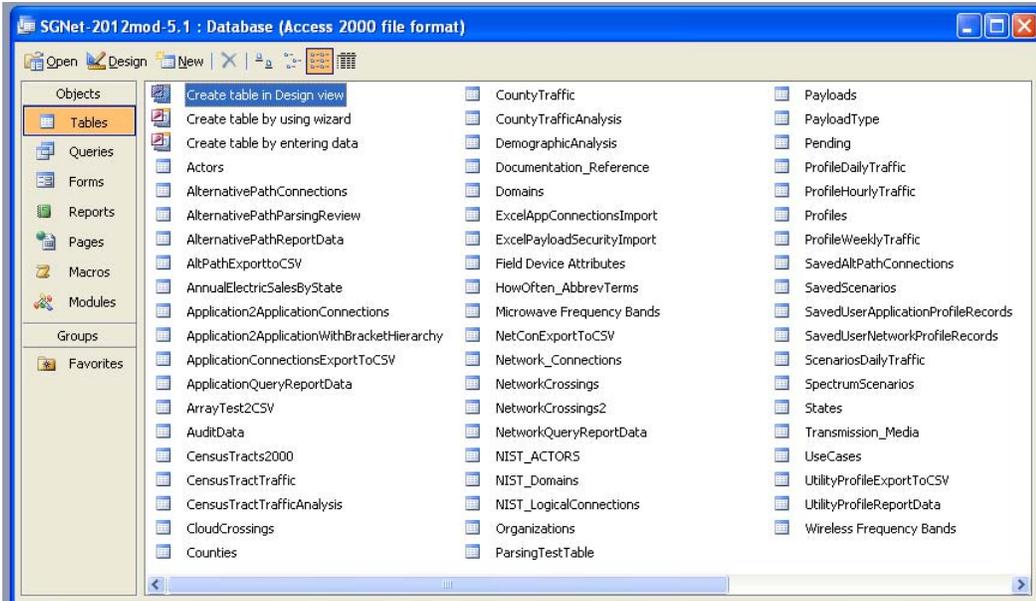
19) Finally the records in the **AlternativePathConnections** table represent alternative paths as first recorded in the SG Network SG Requirements Table spreadsheet file and mapped to the **Application2ApplicationConnections** table. However, they were generated by analysis of the **Application2ApplicationWithBracketHierarchy** 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. The **RePoint** module performs this reindexing task.

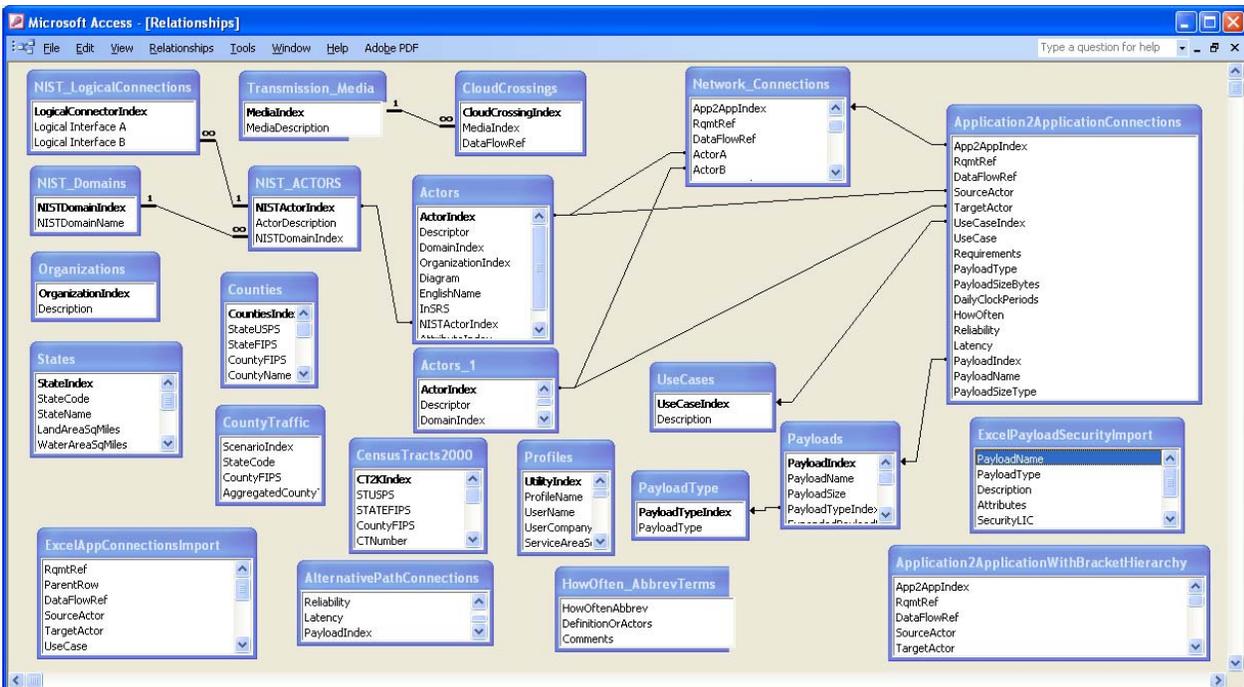
Open the **Repoint** Module, step into the subroutine "Private Sub RePoint()", placing the cursor inside this routine, run it from the arrow on the Toolbar. Note this will take some time.

Appendix B: Table Documentation

Requirements Database Tables

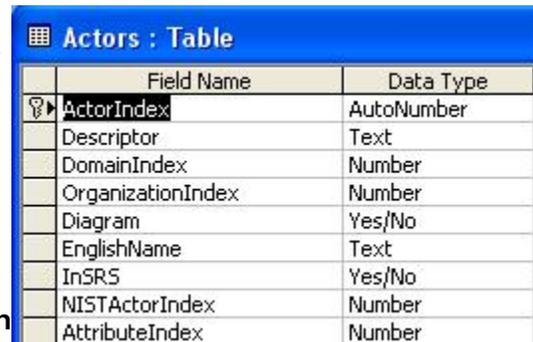


Requirements Database Table Relationships



Actors

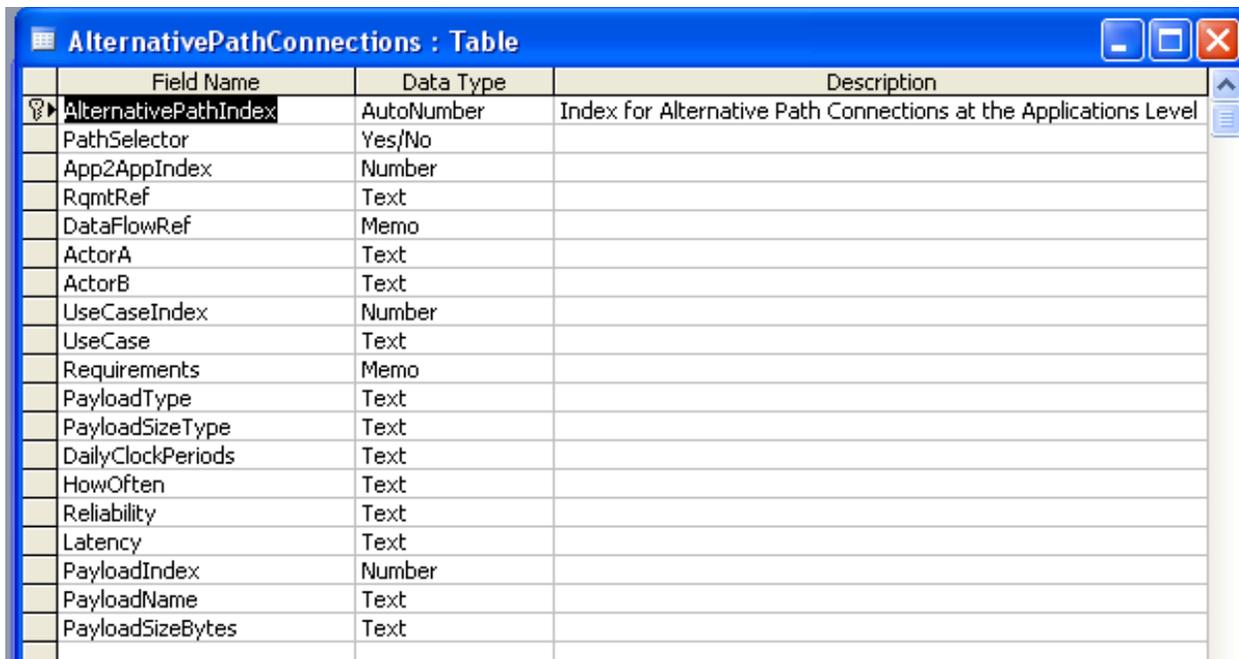
This auto-indexed table holds descriptions of all of the system actors as defined by SG-Network. These are not necessarily the same as the original actors as proposed by NIST, which are described in the **NIST_ACTORS** table. An index is included in the Actors table to allow linkage to **NIST_ACTORS** 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 SG Network Task Force' **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.



	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.



	Field Name	Data Type	Description
▶	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	Text	
	PayloadSizeType	Text	
	DailyClockPeriods	Text	
	HowOften	Text	
	Reliability	Text	
	Latency	Text	
	PayloadIndex	Number	
	PayloadName	Text	
	PayloadSizeBytes	Text	

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.

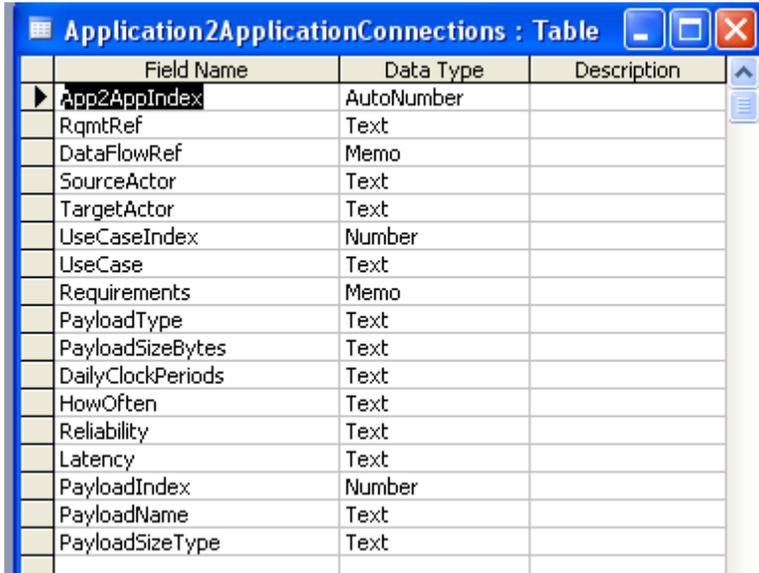
AltPathExporttoCSV : Table	
Field Name	Data Type
PathSelector	Yes/No
App2AppIndex	Number
RqmtRef	Text
DataFlowRef	Memo
SourceActor	Text
TargetActor	Text
UseCaseIndex	Number
UseCase	Text
Requirements	Memo
PayloadType	Memo
PayloadSizeType	Text
DailyClockPeriods	Memo
HowOften	Memo
Reliability	Memo
Latency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

AnnualElectricSalesByState

[work in progress]

Application2ApplicationConnections

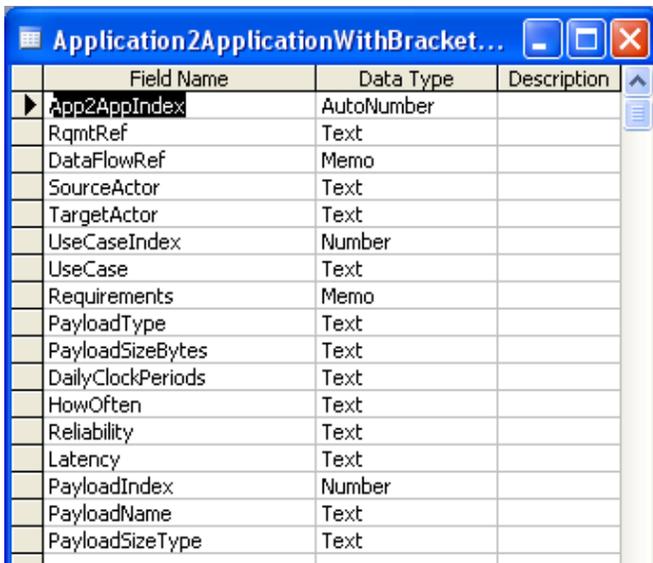
When Application level (Level 7) connections are made defining the transmission of a given Payload message originated by a Source Actor and delivered to a Target Actor, a parent record will be entered into the SG Network Task Force SG Requirements Table, and the Data Flow Reference will be a complex 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.



Field Name	Data Type	Description
App2AppIndex	AutoNumber	
RqmtRef	Text	
DataFlowRef	Memo	
SourceActor	Text	
TargetActor	Text	
UseCaseIndex	Number	
UseCase	Text	
Requirements	Memo	
PayloadType	Text	
PayloadSizeBytes	Text	
DailyClockPeriods	Text	
HowOften	Text	
Reliability	Text	
Latency	Text	
PayloadIndex	Number	
PayloadName	Text	
PayloadSizeType	Text	

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.

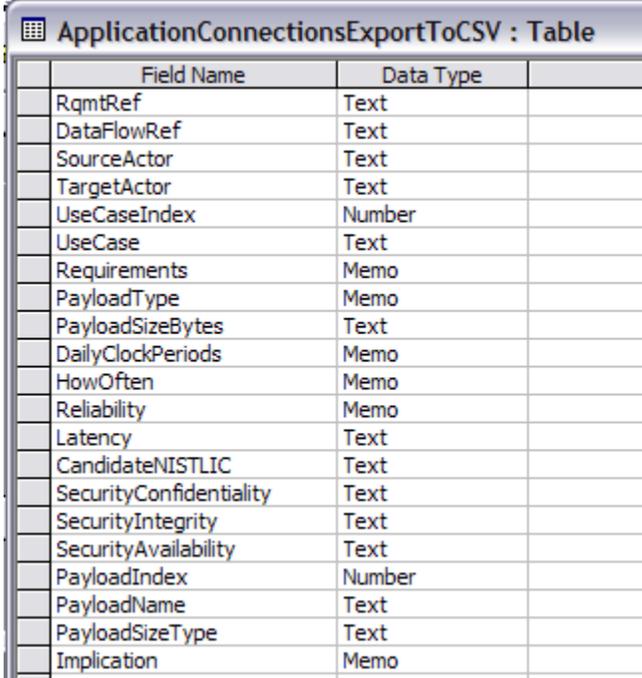


Field Name	Data Type	Description
App2AppIndex	AutoNumber	
RqmtRef	Text	
DataFlowRef	Memo	
SourceActor	Text	
TargetActor	Text	
UseCaseIndex	Number	
UseCase	Text	
Requirements	Memo	
PayloadType	Text	
PayloadSizeBytes	Text	
DailyClockPeriods	Text	
HowOften	Text	
Reliability	Text	
Latency	Text	
PayloadIndex	Number	
PayloadName	Text	
PayloadSizeType	Text	

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.



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.

ApplicationQueryReportData : Table		
	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 SG Network Task Force SG Requirements Table, 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.

AuditData : Table		
	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 **CountyTraffic** 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
NumberWR	Number

Documentation_Reference

This table is provided as a vehicle for documenting the current versions of the SG Network Task Force SG Requirements Table, the SG Network Task Force Reference 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 Microsoft Visio™ diagram that defines the SG Network Task Force Reference 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

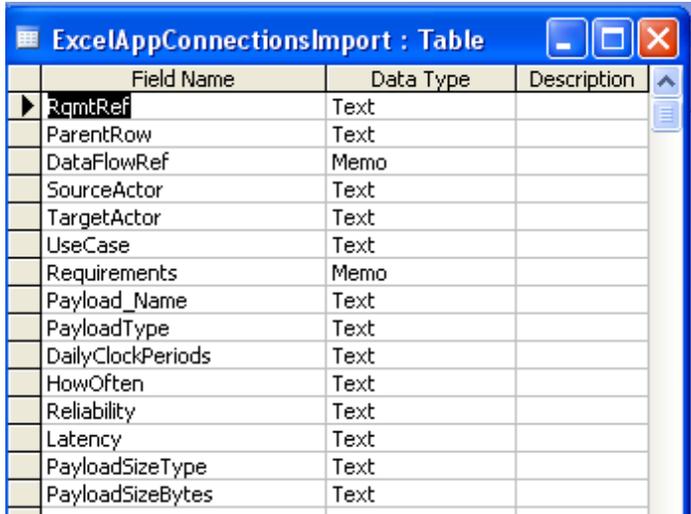
Domains

This table was originally created to allow the flexibility adding additional domains by SG-Network Task Force 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

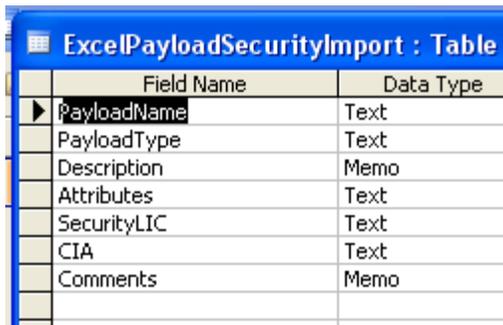
This table is used as the starting point for all analysis work done by this tool. The rows from the SG Network Task Force SG Requirements Table holding the SG Requirements are pasted into a blank version of this table. The table is not indexed.



Field Name	Data Type	Description
RqmtRef	Text	
ParentRow	Text	
DataFlowRef	Memo	
SourceActor	Text	
TargetActor	Text	
UseCase	Text	
Requirements	Memo	
Payload_Name	Text	
PayloadType	Text	
DailyClockPeriods	Text	
HowOften	Text	
Reliability	Text	
Latency	Text	
PayloadSizeType	Text	
PayloadSizeBytes	Text	

ExcelPayloadSecurityImport

This file holds the contents of the **Payload_attrib_LIC_CIA_rtnl** tab on the SG Networks Task Force SG Requirements Table. 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	Text
PayloadType	Text
Description	Memo
Attributes	Text
SecurityLIC	Text
CIA	Text
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	

HowOften_AbbrevTerms

This table has been added to support parsing and scaling of the HowOften field of the **ExcelAppConnectionsImport** table.

HowOften_AbbrevTerms : Table			
Field Name	Data Type	Description	
HowOftenAbbrev	Text		
DefinitionOrActors	Text		
Comments	Text		

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 Microsoft 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.

NetworkQueryReportData : Table		
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	

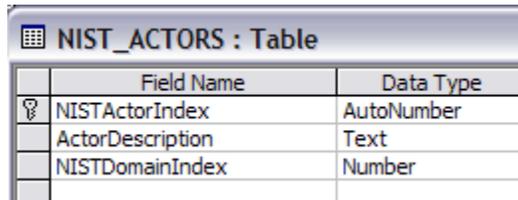
Network_Connections

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

Network_Connections : Table			
Field Name	Data Type	Description	
NetConnectIndex	AutoNumber	Index for Connections below the Applications Level	
App2AppIndex	Number		
RqmtRef	Text		
DataFlowRef	Memo		
ActorA	Text		
ActorB	Text		
UseCaseIndex	Number		
UseCase	Text		
Requirements	Memo		
PayloadType	Text		
PayloadSizeType	Text		
DailyClockPeriods	Text		
HowOften	Text		
Reliability	Text		
Latency	Text		
PayloadIndex	Number		
PayloadName	Text		
PayloadSizeBytes	Text		

NIST_ACTORS

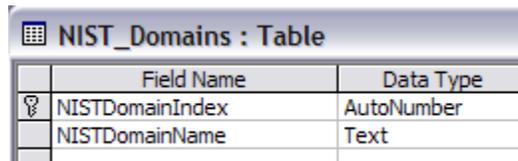
The list of actors originally established by NIST in the Interoperability Standards Roadmap are maintained in this table as an indexed list.



	Field Name	Data Type
🔑	NISTActorIndex	AutoNumber
	ActorDescription	Text
	NISTDomainIndex	Number

NIST_Domains

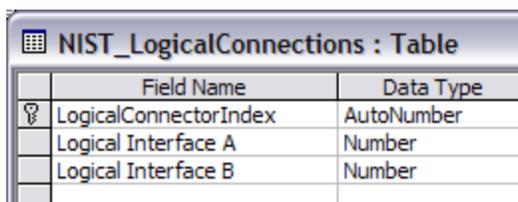
This table holds an indexed list of the NIST Domains.



	Field Name	Data Type
🔑	NISTDomainIndex	AutoNumber
	NISTDomainName	Text

NIST_LogicalConnections

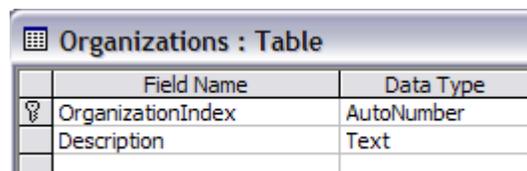
At the beginning of this work, the connections between NIST Actors were codified and placed in this table as an indexed list.



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

Organizations

Within the NIST framework of Domains, the Operations domain is further subdivided 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.

	Field Name	Data Type	Description
	PayloadIndex	AutoNumber	
	PayloadName	Text	
	PayloadSize	Text	Bytes
	PayloadTypeIndex	Number	
	ExpandedPayloadName	Text	
	Description	Memo	
	Attributes	Text	
	SecurityLIC	Text	
	CIA	Text	
	Comments	Memo	

PayloadType

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

	Field Name	Data Type
	PayloadTypeIndex	AutoNumber
	PayloadType	Text

Profiles

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

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 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

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.

ProfileDailyTraffic : 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
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.

ProfileHourlyTraffic : Table	
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.

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

SpectrumScenarios : Table		
	Field Name	Data Type
🔍	SpectrumScenarioIndex	AutoNumber
	UtilityIndex	Number
	ScenarioName	Text
	WirelessPropModelIndex	Number
	BackhaulFreqBandIndex	Number
	NumberFeedersPerSub	Number
	NumberEndPointsPerFeeder	Number
	NumberReclosersPerFeeder	Number
	NumberSwitchesPerFeeder	Number
	UncorrectedResPPFCT	Number
	UncorrectedCommPPFCT	Number
	ObjectivePPFCT	Number
	AveCapBankRatingKVA	Number
	RatioCapbanks2VR	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.

SavedUserApplicationProfileRecords : Table		
	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

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

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

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	
RgmtRef	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	
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	
NumberMetersWEST	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	
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	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:

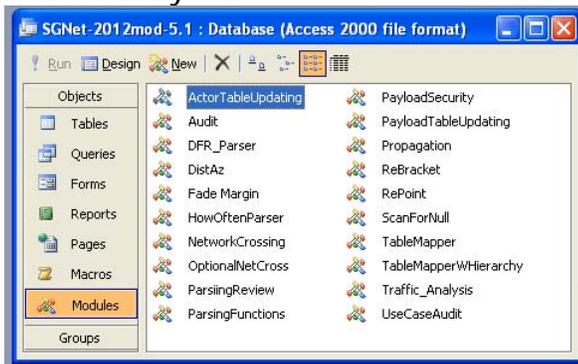
UtilityProfileReportData : Table			
Field Name	Data Type		Description
ProfileName	Text		
UserName	Text		
UserCompany	Text		
ServiceAreaSqMiles	Number	Service Area in Square Miles	
NumberDAPS	Number		
AveNumberDAPSPerSM	Number		
AveDAP2DAP	Number		
AveDAPServiceAreaSM	Number		
AveDAPServiceAreaRadius	Number		
NumberDAPUpdateEventsPer	Number		
NumberElectricCIMeters	Number		
NumberSWOperationsPerMet	Number		
NumberElectricResidentialMe	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		
NumberSWOperationsPerPrel	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.



Software License

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

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