Transaction Scenarios:

Discovering a Method for the IDC to Determine Transmission Service Usage

NAESB Business Practices Subcommittee

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Scenario Assumptions

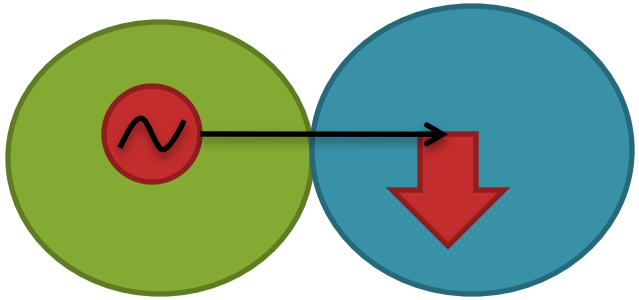
- All transactions entering or leaving a BA boundary (inter-BA) should be captured by the IDC.
- My assumption within these examples is that inter-BA transactions are tagged and therefore captured by the IDC.
- The scenarios herein, therefore, address the intra-BA transactions which the IDC currently does not see.

Scenarios

Scenario #	Source Location	Tagged ?	Source Known ?
1	External	YES	YES
2	External	YES	NO
3	External	NO	YES
4	External	NO	NO
5	Internal	YES	YES
6	Internal	YES	NO
7	Internal	NO	YES
8	Internal	NO	NO

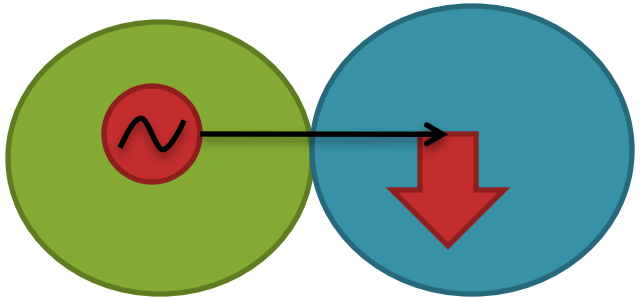
Scenario #1 – External, Tagged, Known-Source

Since this transaction is tagged and the source is known the impact should be based on the Generation to Load Distribution Factor (GLDF = GSF - LDF)



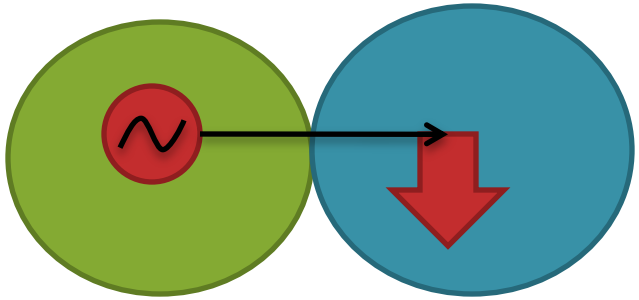
Scenario #2 – External, Tagged, Unknown Source (e.g. LD Contract)

Since this transaction is tagged, the IDC is able to identify it and therefore can calculate the impacts based on current Area-to-Load distribution factors (LDF - LDF).



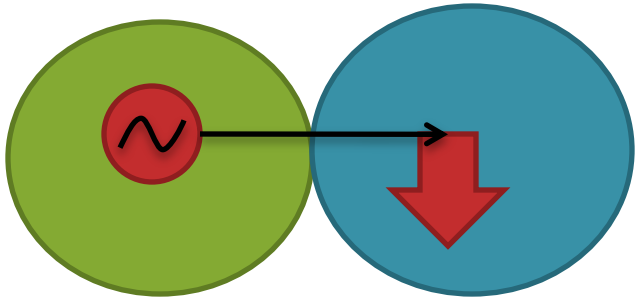
Scenario #3 – External, Un-tagged, Source Known

If this scenario exists NAESB should consider requiring the tagging of all inter-BA transactions regardless of service type (Network or PtP).



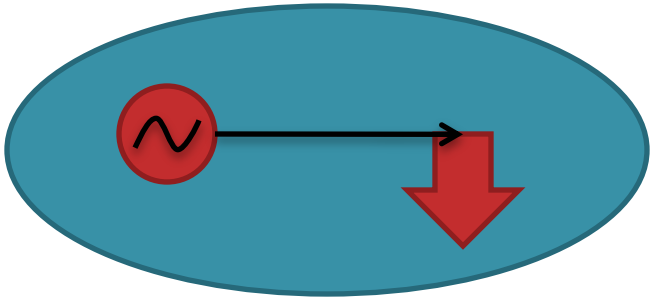
Scenario #4 – External, Un-tagged, Source Unknown

If this scenario exists NAESB should consider requiring the tagging of all inter-BA transactions regardless of service type (Network or PtP).



Scenario #5 – Internal, Tagged, Source Known

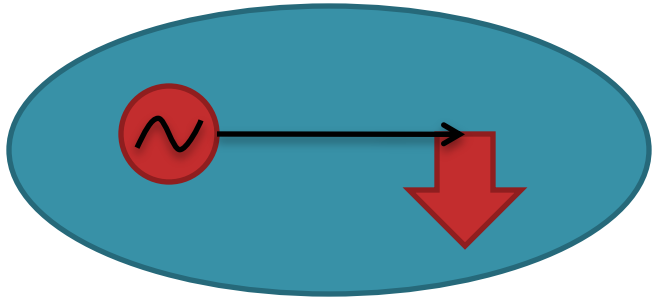
Since this transaction is tagged and the source is known, impacts should be based on the GLDF. Change Order 310 is needed!



Scenario #6 – Internal, Tagged, Source Unknown

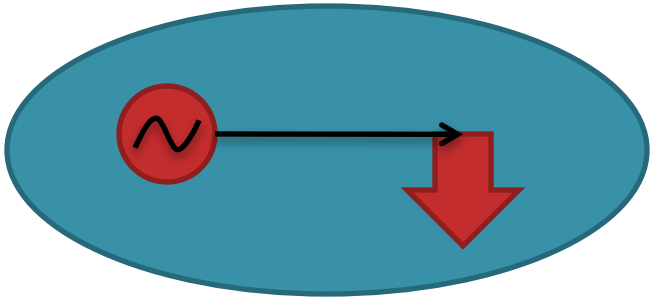
Since this transaction is tagged, the IDC should be able to observe the transaction once Change Order 310 is implemented.

But how shall we calculate impacts without a known source? Assume transaction is untagged and use a combination of solutions as presented herein.



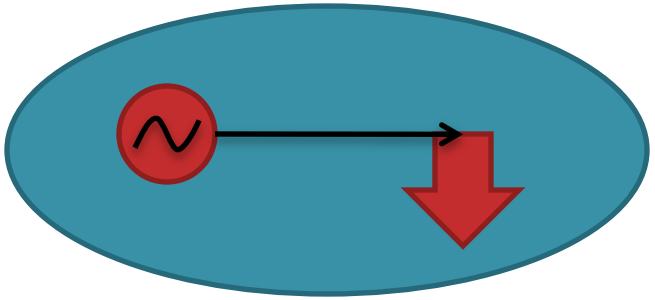
Scenario #7 – Internal, Untagged, Source Known

Knowing what the source is seems irrelevant here because there is no tag. Assume this to be treated the same as Scenario #8.



Scenario #8 – Internal, Untagged, Source Unknown

Potential Solutions to follow



How to Deal with Unknowns

- Tagged transactions with sources that are contract-based (Subsystem Example)
- Transactions with sources that are generic (e.g. “slice-of-system” without “slice” details – Marginal Generation Example)
- Untagged transactions (Firm-Resource List Example, Tag-Everything Example)
- Remember, our goal is to identify firm vs. non-firm **transmission service** usage.

Tagged Transactions with Sources that are Contract-Based (Subsystem)

If contract sources are entitlements from a specific set of units…

Impact = $GSF_{Avg} - LDF$

Where, $GSF_{Avg} = \sum_i \left(GSF_i \times PF_i \right)$

PF = Participation Factor at each bus (i)

$$PF_i = \frac{Entmnt_i(MW)}{\sum_i Entmnt_i}$$

Entmnt = Contract Entitlement (MW) from Generator at bus i

% vs MW Entitlement Allocations

- What if the entitlement is %-based rather than MW-based?
- Calculate the MW based on a static % and the RT output of the generator (need Change Order 283).

Subsystem Example

This example presents an alternative solution to dealing with transactions which are tagged but have sources which are based on a **known** pool of resources (e.g. a potential use of “slice-of-system”)

The pool of units in this example include five generators with different contract entitlement quantities and which are located at different parts of the system

Subsystem Example:
Determination of Participation Factors

	A	B	C	D	E
1	Unit #	Capacity (MW)	Entitlement (%)	Entitlement (MW)	Participation Factor
2	1	1000	0.1	100	0.2447
3	2	500	0.5	250	0.6118
4	3	350	0.13	45.5	0.1113
5	4	250	0.04	10	0.0245
6	5	125	0.025	3.125	0.0076

D2 = C2 * B2
E2 = D2 / SUM(D2:D6)
Capacity and Entitlement are **GIVEN**

Subsystem Example:
Determination of Aggregate GSF

Assume a constraint exists and GSFs on the constraint from the previous units are as follows:

	A	B	C	D
1	Unit #	GSF (%)	Impact (MW)	Aggregate GSF (%)
2	1	0.025	2.5	0.0061
3	2	0.05	12.5	0.0306
4	3	0.09	4.095	0.0100
5	4	0.35	3.5	0.0086
6	5	0.9	2.8125	0.0069
7	-	-	25.4075	0.062178

C2 = B2 * Entitlement (MW)
D2 = Participation Factor * B2
Entitlement MW and **Participation Factor** are taken from the previous slide

Summary of Subsystem Example

- **Maximum impact allocated to this entity is** 0.062178 (aggregate GSF) times total Entitlement MW (408.625 MW in this example) = **25.4075 MW**

- If contracts change (allocation of resources or units within the subsystem) the IDC would need to be updated to reflect these changes.

Marginal Generation Example

- An example of when this may be applicable is for “System Generation” contracts where a source isn’t specified but the energy typically comes from the marginal resources of an area’s generation mix.
- There are three ways that this could be handled using the generation allocation method
  - 1. Create a subsystem of (online) market resources which are most often the marginal units and use their participation factors
  - 2. Use the process of 1) but provide regular updates of the marginal units to be used in the subsystem file. (Does this provide too much flexibility to some entities?)
  - 3. Use all system resources based on their participation factors except Nuclear reactors and resources flagged as “baseload”.
- How do you account for local uses since undesignation isn’t required for non-firm sales using firm trans? Is this accounted for in the Firm Resource List Example? (Can we use this and the Firm Resource List approach as a hybrid to make everything work?)

Marginal Generation Example

Using the same set of five units from the “Subsystem Example”…

Two flags are added to the data that the IDC will receive to indicate marginal status of the unit (“Marginal”) as well as whether the unit is online (“Online”)

Marginal Generation Example:
Marginal and Online Flags

	A	B	C	D	E	F	G
1	Unit #	Capacity (MW)	Entitlement (%)	Entitlement (MW)	Participation Factor	Marginal	Online
2	1	1000	0.1	100	0.0000	0	1
3	2	500	0.5	250	0.0000	0	1
4	3	350	0.13	45.5	0.9357	1	1
5	4	250	0.04	10	0.0000	1	0
6	5	125	0.025	3.125	0.0643	1	1

“Marginal" flag places that unit into a "Marginal Generation" subsystem to be used for re-dispatch of system-sourced transactions

“Marginal" flag will be ignored if "Online" flag is zero

E4 = D4/SUM(D4,D6
Removed impacts of non-marginal or offline units

Marginal Generation Example

Aggregate GSF for Marginal Subsystem

	A	B	C	D	E	F
1	Unit #	GSF (%)	Impact (MW)	Aggregate GSF (%)	Marginal	Online
2	1	0.025	2.5	0.0000	0	1
3	2	0.05	12.5	0.0000	0	1
4	3	0.09	4.095	0.0842	1	1
5	4	0.35	3.5	0.0000	1	0
6	5	0.9	2.8125	0.0578	1	1
7	-	-	6.9075	0.1420566	-	-

This subsystem's impact is the aggregate GSF multiplied by the sum of all generation from the units within the "Marginal Generators" subsystem

C7 = C4+C6

Marginal Generation Example

- **Maximum impact allocated to this entity is** 0.1420566 (aggregate GSF) times total Entitlement MW from online, marginal generators (45.5 MW + 3.125 MW = 48.625 MW in this example) = **6.9075 MW**

- "Marginal Generators" subsystem can be updated dynamically as the market conditions dictate

- Regardless of how often the "Marginal Generators" subsystem is updated, the IDC should still be able to calculate the GSFs for the units within this subsystem in near real-time

Firm-Resource List Example

- Avoided calling this a DNR list since not all entities call their firm installed capacity resources as Designated Network Resources
- In this approach, a regularly updated (as designations are made) list of resources that are designated as firm resources (or DNRs) is made available to the IDC.
- The list provides the IDC with the unit's capacity designated for firm uses and compares this firm designation with the actual output of the unit (need Change Order 283). Any deviation between the designation and the actual output is flagged as non-firm transmission use EXCEPT for any tags which specifically use this resource as a source (either directly or through a subsystem definition).
- NAESB would need to deal with the logistics of this list's creation including periodicity of submission to the IDC as well as its format.

Firm-Resource List Example

Using the same set of five units…

These units are included in an entity's list of "Firm Resources" as follows:

	A	B
1	UNIT #	Capacity FIRM (MW)
2	1	900
3	2	250
4	3	100
5	4	50
6	**5**	**0**

Unit #5 will not be included in the "Firm Resources" list but it is shown here as a zero-valued placeholder.

Firm-Resource List Example

Another entity has submitted a list of their entitlement generators as a “Firm Resource” list rather than tagging these transactions. Using the same five units we now have the following:

	A	B	C
1	UNIT #	Capacity FIRM (MW) **Entity A**	Capacity FIRM (MW) **Entity B**
2	1	900	100
3	2	250	250
4	3	100	45.5
5	4	50	10
6	**5**	**0**	3.125

Firm-Resource List Example

	A	B	C	D	E
1	UNIT #	Capacity FIRM (MW) **Entity A**	Capacity FIRM (MW) **Entity B**	Total Unit Capacity (MW)	IDC Assumption for **Non-Firm Usage** (MW)
2	1	900	100	1000	0
3	2	250	250	500	0
4	3	100	45.5	350	204.5
5	4	50	10	250	190
6	**5**	**0**	3.125	125	121.875

IDC would use a combination of tags, subsystem definitions (for tags with generic sources), and “Firm Resource Lists” to determine transmission service usage.

E5 = D5 – SUM(B5,C5)

Firm-Resource List Example

If a unit is generating more MW than is designated as firm usage (or tagged-FIRM usage) the remaining MW are assumed non-firm.

If a unit is de-rated and/or a portion of the unit has been sold as a tagged transaction and the sum of the firm designations by all parties (through their “Firm Resource” lists) is greater than the online-MW level, the IDC would translate the non-tagged MW designations to %-of-online-capacity designations (default).

Example, unit #1 (1000MW) is de-rated to 800MW which is less than the 1000MW of firm designations. Translation to % would be (900/1000)*800 = 720MW and (100/1000)*800 = 80MW.

NEED TOTAL UNIT CAPACITY IN THE IDC

Firm-Resource List Example

- How does this work with “Slice of System” uses?
- A hybrid approach is needed where a combination of the “Subsystem”/”Marginal Units” approach and “Firm Resources List” approach would work in concert to identify transmission service usage.
- A hybrid approach is needed in order to ensure usage isn’t double counted.
- An example of how these would work together can be created by assuming only “Entity A” submitted a “Firm Resources List” and Entity B used a subsystem approach while a third Entity uses a marginal generator approach.
- In any case, the IDC should keep track of the MW it is assuming to come from each unit and should adjust the MW allocation whenever there are conflicts based on a priority flag.

Pecking Order for Data Inconsistencies: Priority Level Concept

A pecking order is needed in order to deal with inaccurate data so the IDC knows which data to trust more.

A priority level would be associated with each method used, to decide MW allocations based on the expected accuracy of the method used as well the Time of Last Update (TLU) of the files used.

Priority Level Concept: Example

If a unit is included on a Firm Resources List, this MW allocation is prioritized as Level 1 (L1). If the “Firm Resources List’s” TLU is greater than seven calendar days then the MW allocations are prioritized as L2.

If a unit is identified as the source in a tagged transaction, this allocation is prioritized as L1.

If a unit is included in any type of subsystem including “Marginal Generator” subsystems, this allocation is prioritized as L2 unless the subsystem was changed in the last 12 hours which would increase the priority to L1.

During conflicts, all L1 priorities are assumed more accurate and then L2 allocations are used pro-rata.

Tying this back to the Firm Resource List Example…

From page 28:

If a unit is de-rated and/or a portion of the unit has been sold as a tagged transaction and the sum of the firm designations by all parties (through their "Firm Resource" lists) is greater than the online-MW level, the IDC would translate the non-tagged MW designations to %-of-online-capacity designations (default).

Priority level would also come into play here in order for the IDC to determine if a given "Firm Resource List" has a higher priority level than another. All levels being equal, the IDC would default to the % translation as described above.

Generator Prioritization Summary

- The previous slides provided some examples of how to potentially implement a generator prioritization method to allocate firm and non-firm transmission usage on a unit-level.

- The final alternatives are to tag all PtP and non-firm network service or to tag everything. These approaches are more difficult to manage from an overhead point-of-view but certainly make our goals more attainable in identifying transmission usage in a more equitable manner.

Tag-Almost Everything Example

- What about tagging all **PtP and non-firm Network**?
- Still need subsystem approach for slice-of-system transactions (and accompanying prioritization levels)
- IDC will assume everything is FIRM and allocate non-firm uses on a unit-by-unit basis depending on submitted tags.
- Seems like a more straight-forward solution

Tag-Everything Example

- What drawbacks exist if everything is tagged?
- Still need to use a hybrid approach for those reservations that specify subsystems as a source (Subsystem Example) as well as “prioritization level”.
- “Standing tags” for Nuclear units and other baseload or grandfathered transactions which only need to be adjusted during outages or system emergencies.
  - This might help with some of the overhead involved in submitting tags at regular intervals.