# Pricing Interchange with a Full Network Model

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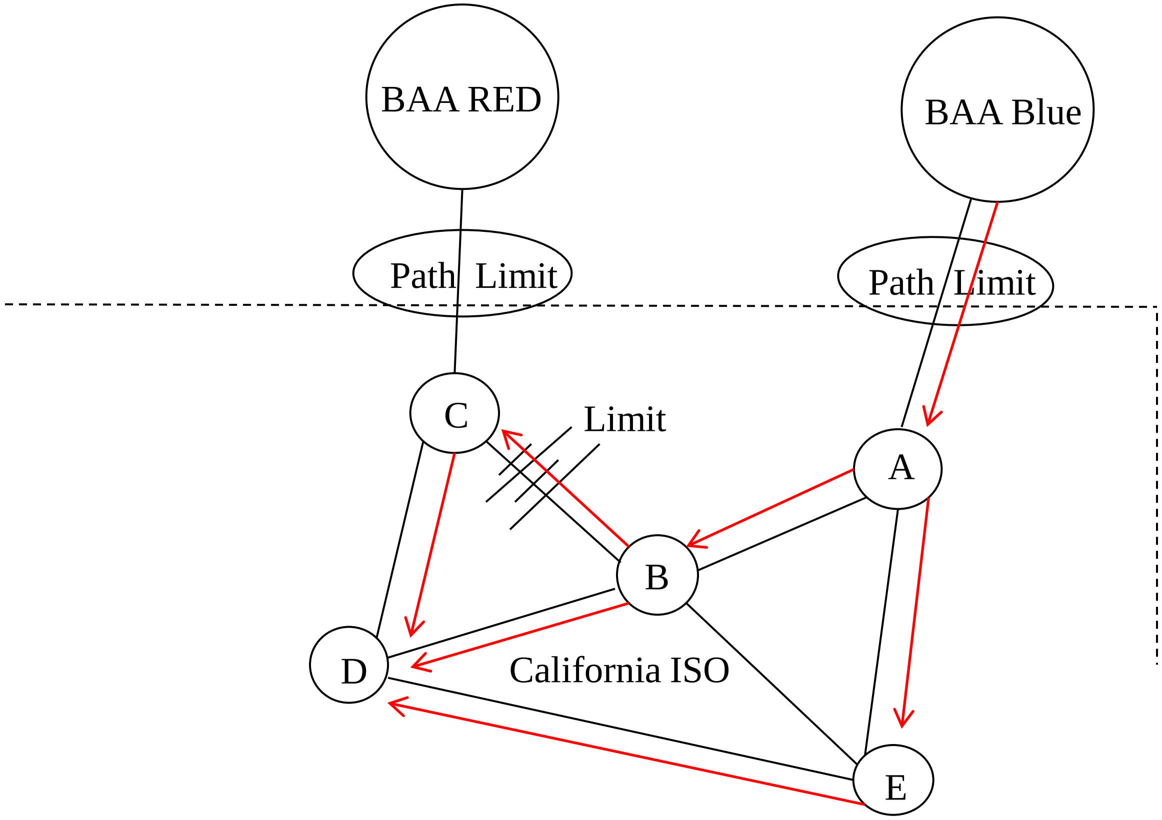
Figure 1

# Radial Model



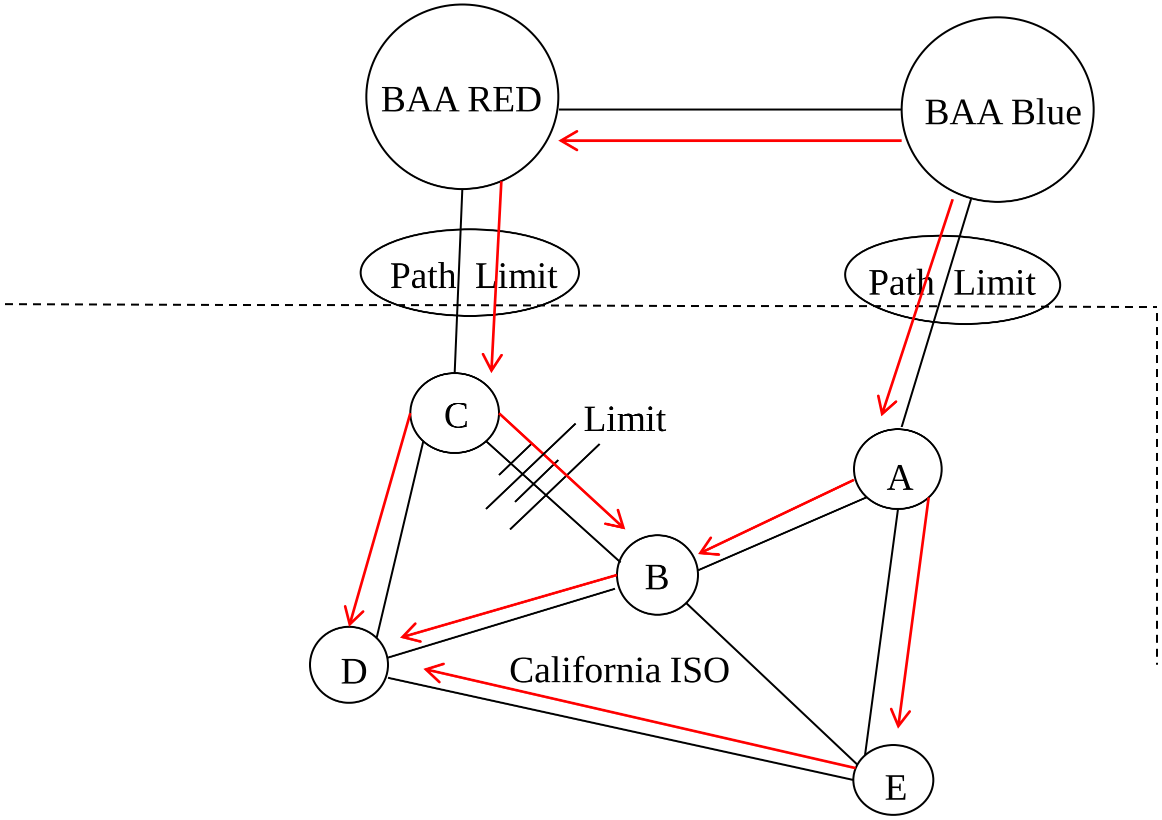
# Radial Model

Figure 1 shows an illustrative radial model of the California ISO's interconnection with BAA's Red and Blue.

- When the impact of imports from Red and Blue on constraint C-B is calculated using this radial model, imports from BAA Blue will appear to create no flows over line C-B and would likely even provide some counterflow over the path A-B-C-D.
- This would cause transactions sourced at BAA Blue to have a higher price than transactions sourced at BAA Red when constraint C-B is binding, as long as the contract path limit on imports from BAA Blue does not bind.

Figure 2

# Partial Network Model



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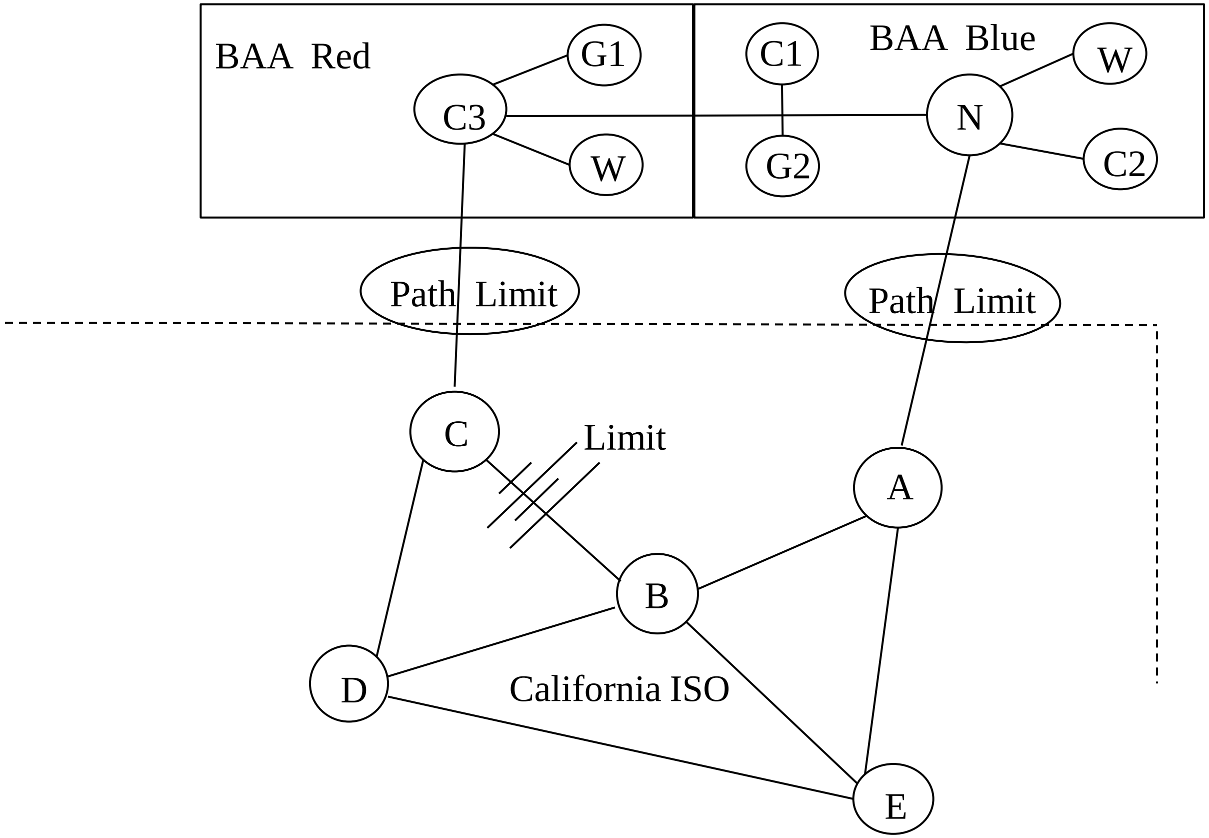
# Partial Network Model

Figure 2 shows the same model of the California ISO network, with one external line added, a line between BAA Blue and BAA Red.

- If the impact of imports from BAA Red and BAA Blue on constraint C-B is calculated using this expanded model, imports from BAA Blue would create flows over line C-B, as part of the imports from BAA Blue would flow around over the path through BAA Red and over the path C-B-D.
- Transactions modeled as sourced at BAA Blue would have a higher price than transactions sourced at BAA Red when constraint C-B is binding, because of the greater impact on constraint C-B, but the price difference would be smaller than with a radial model.

Figure 3

# Full Network Model



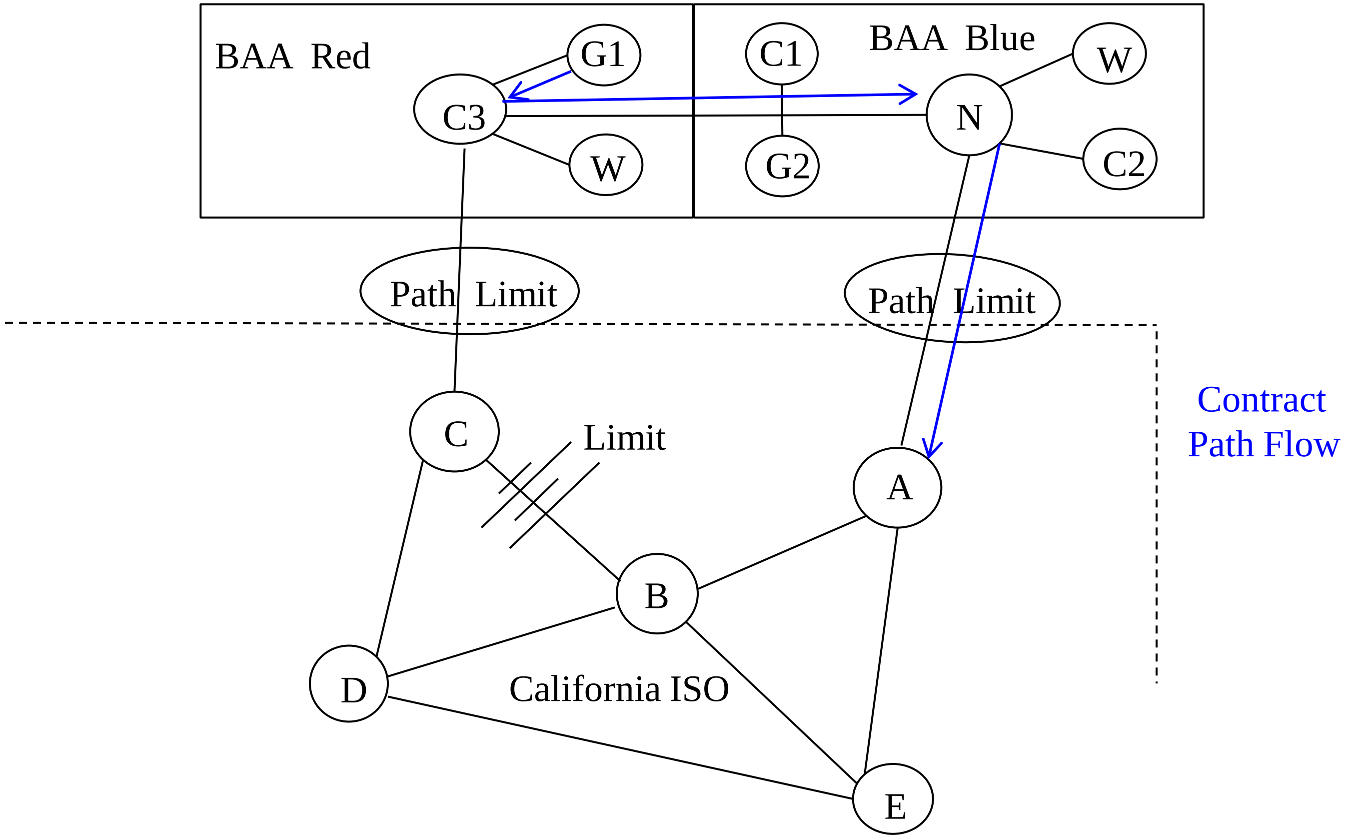
# Full Network Model

The model portrayed in Figure 2 is still simplified, as the actual flows associated with imports from BAAs Red and Blue would depend on the generation source within the BAA that would be actually incremented to support imports.

- Figure 3 shows the generation resources within each BAA (C= coal, N = nuclear, G = gas and W = wind).
- While the coal and nuclear plants in BAA would be operating during the on peak hours and could contribute to loopflows over the California ISO system, they would not likely be incremented or decremented to support increases or decreases in exports to California.
- The actual generation resource supporting the imports from BAA Blue would more likely be the gas fired generation at G2, which would cause larger flows over line C-B than would imports supported by the nuclear generation or C2.

Figure 4

# Full Network Model



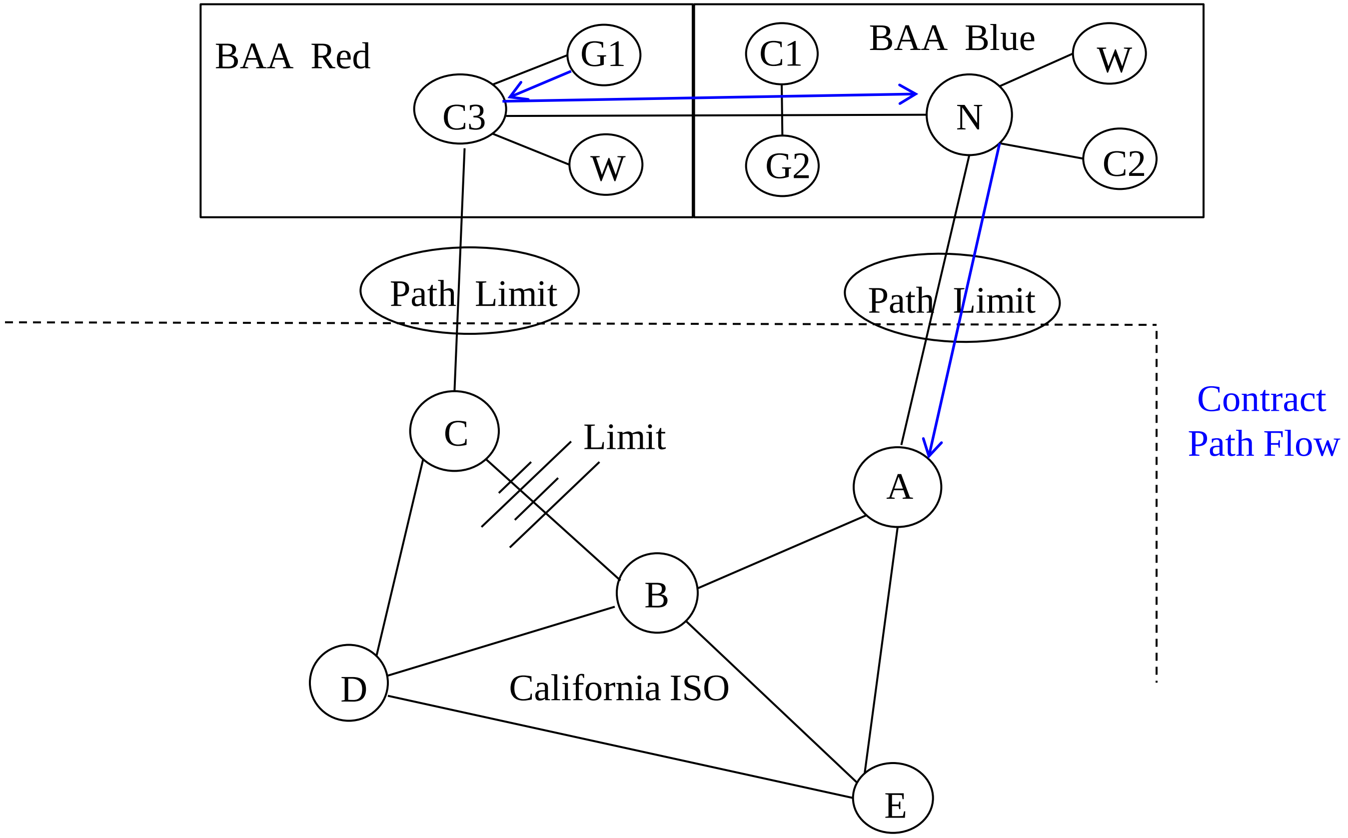
# Full Network Model

Transactions scheduled from BAA Blue might actually be supported by generation incremented in BAA Red as shown in Figure 4.

- An import from BAA  Blue could be supported by increased output at G1 in BAA Red, with an interchange schedule from BAA Red to Blue, then a schedule from BAA Blue to the California ISO.
- The ultimate generation source is not necessarily indicated by the transaction tag, as power could be purchased from G1 and used to meet load in BAA Blue, with a completely different transaction tagged from the nuclear plant to support an export to the California ISO.
- The impact of this transaction on constraint C-B would be determined by the location of the generation incremented to support the transaction (G1), not the nominal BAA source (Blue).

Figure 4

# Full Network Model



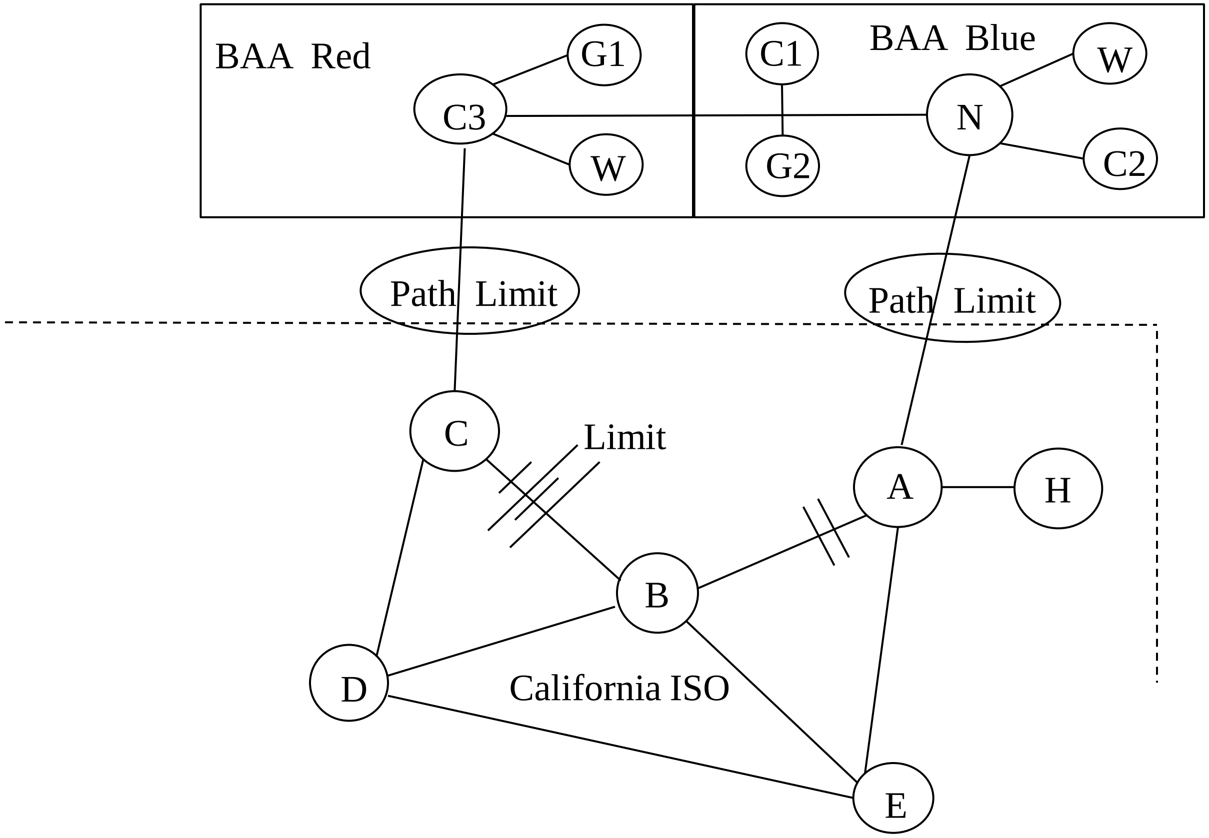
# Full Network Model

One way to price imports sourced from BAA Red and Blue would be to calculate congestion impacts and prices using a likely worst case assumption, perhaps that imports from either BAA Red or BAA Blue would be sourced from generator G1.

- Entities able to sell power from a more favorably situated resource could enter into a MEEA or join the EIM and obtain more accurate pricing.
- Factors favoring the application of this approach would be the existence of a key constraint that is materially impacted by interchange schedules, significant differences in how resources likely to be on the margin impact the constraint, and low costs to scheduling transactions on alternative contract paths.

Figure 5

# Full Network Model



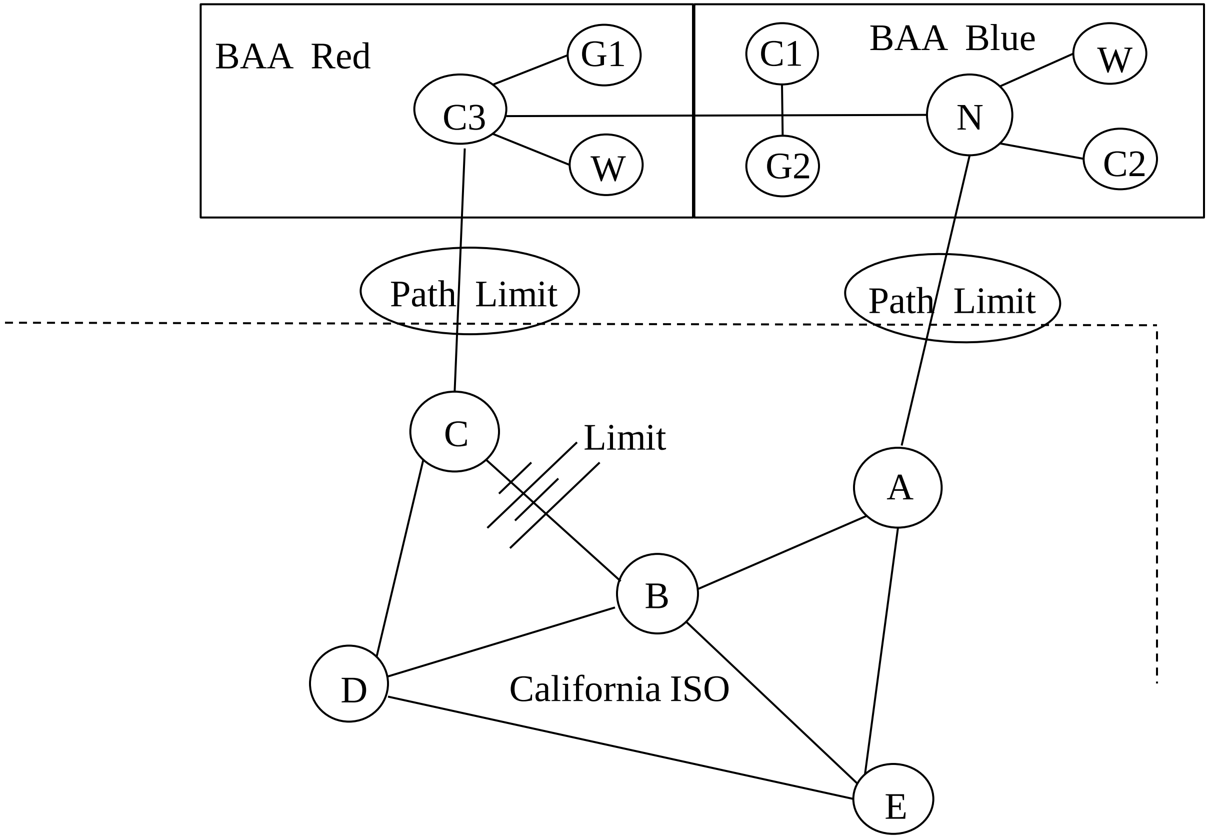
# Full Network Model

A limitation of trying to select a proxy bus for modeling and pricing is that the worst case location for congestion impacts will differ across constraints and multiple constraints may be binding in some hours.

- Figure 5 adds a hydro resource within the California ISO at H that causes the line A-B to bind when the hydro resource is dispatched in combination with high levels of imports.
- With the constraint A-B binding, generation at G1 may not be the worse case assumption.
- This situation could tend to favor using a proxy bus whose weights roughly reflect the typical pattern of import impacts.

Figure 3

# Full Network Model



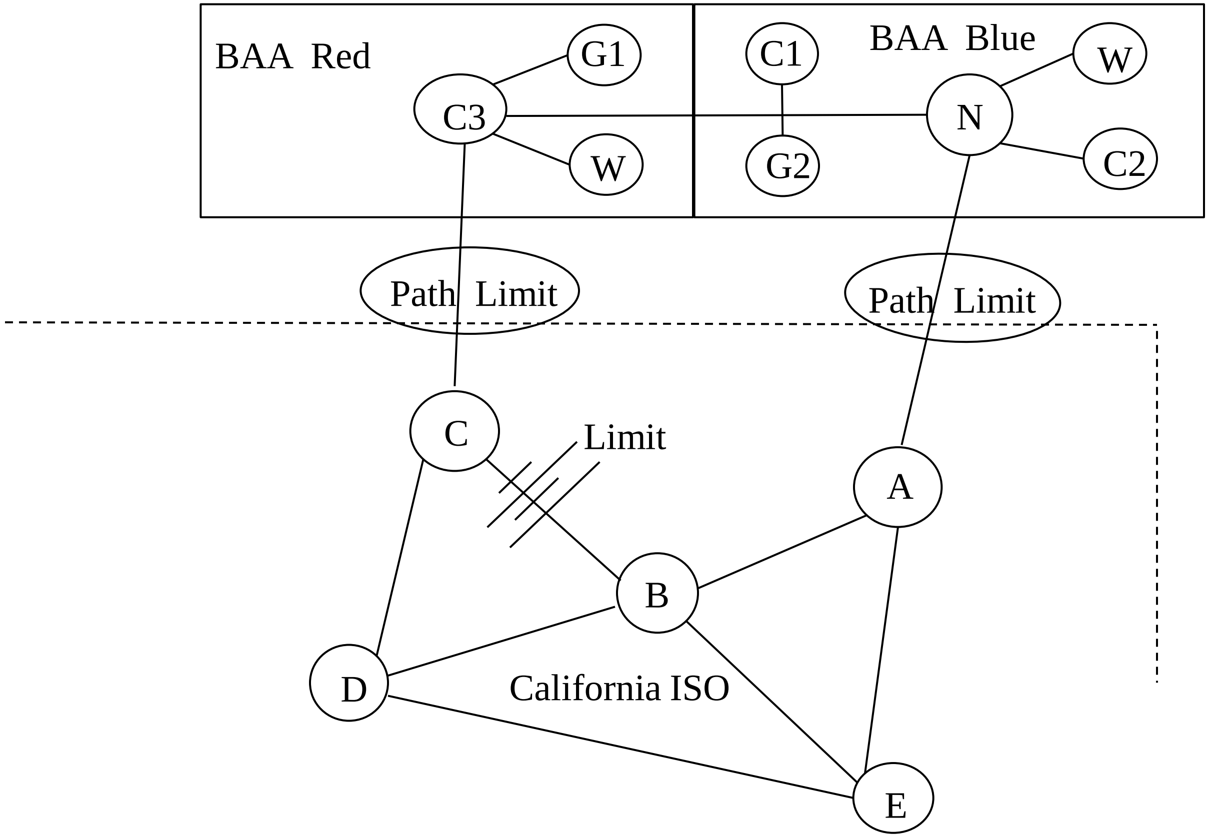
# Full Network Model

Such an approach could be to use a weighted average of the prices for generation at G1 and G2 to price imports from both BAA Red and BAA Blue.

- Entities with more favorably located supply could enter into a MEEA or join the EIM under this approach as well.
- Factors favoring this approach would be the existence of multiple constraints that bind in real-time and are impacted in different ways by likely generation sources, and multiple generation sources for imports with varying impacts on likely constraints but similar dispatch costs.

Figure 3

# Full Network Model



# Full Network Model

Another approach would be to use a weighted average of all of the generation in the source BAAs to model transmission impacts and determine prices.

- While modeling the impact of the base load generation on California ISO transmission lines may be useful in analyzing loopflows, this will not accurately model the change in flows attributable to changes in net interchange.
- BAA Blue will not be incrementing or decrementing its nuclear plant with variations in net interchange and the coal plants also likely would not be moving up and down to support changes in net interchange during the on–peak hours.

# Conclusions

The best approach to modeling and pricing net interchange may not be the same across all California ISO external interfaces.

- The choices for modeling and price will work out best if they are informed by information regarding which constraints are materially impacted by external resources and likely to bind, which resources are generally moved to support changes in net interchange and how they impact the constraints.
- Even if the resources generally moved cannot be directly observed, the California ISO can analyze how flows on key constraints have changed with changes in net interchange with particular BAAs and infer how to model the source.

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