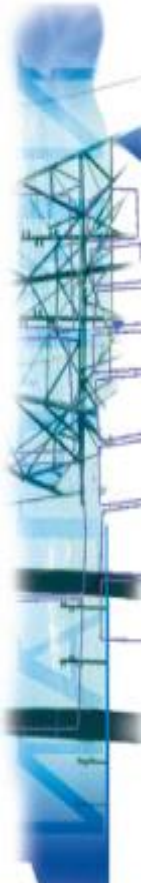
Dynamic Thermal Circuit Reliability (DTCR)

Using Models, PI, PI-ACE, Process Book, and the Module Database

Topics to be Covered



- What is DTCR?
- Sources of DTCR information
- Choosing the appropriate technology solutions
- Discussion of Example
- Questions?

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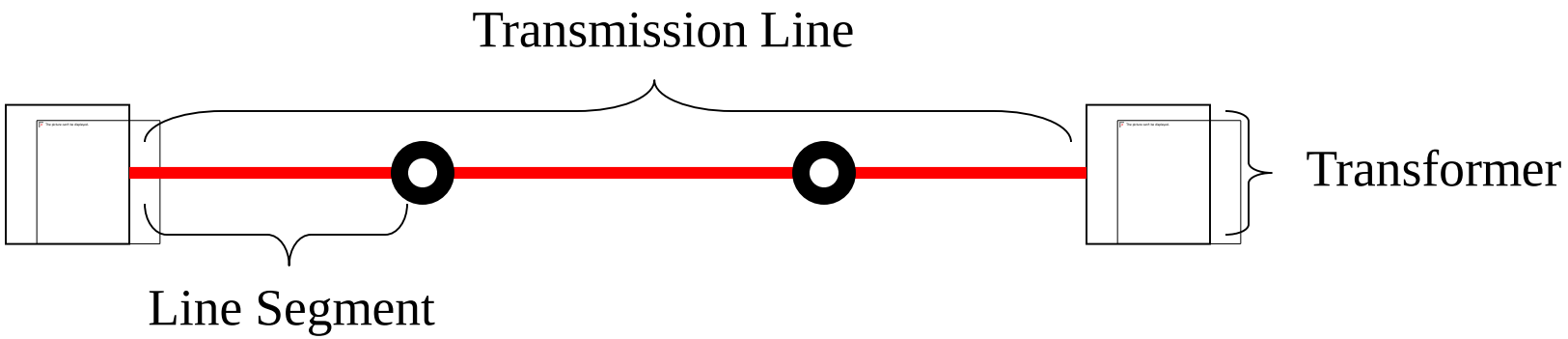
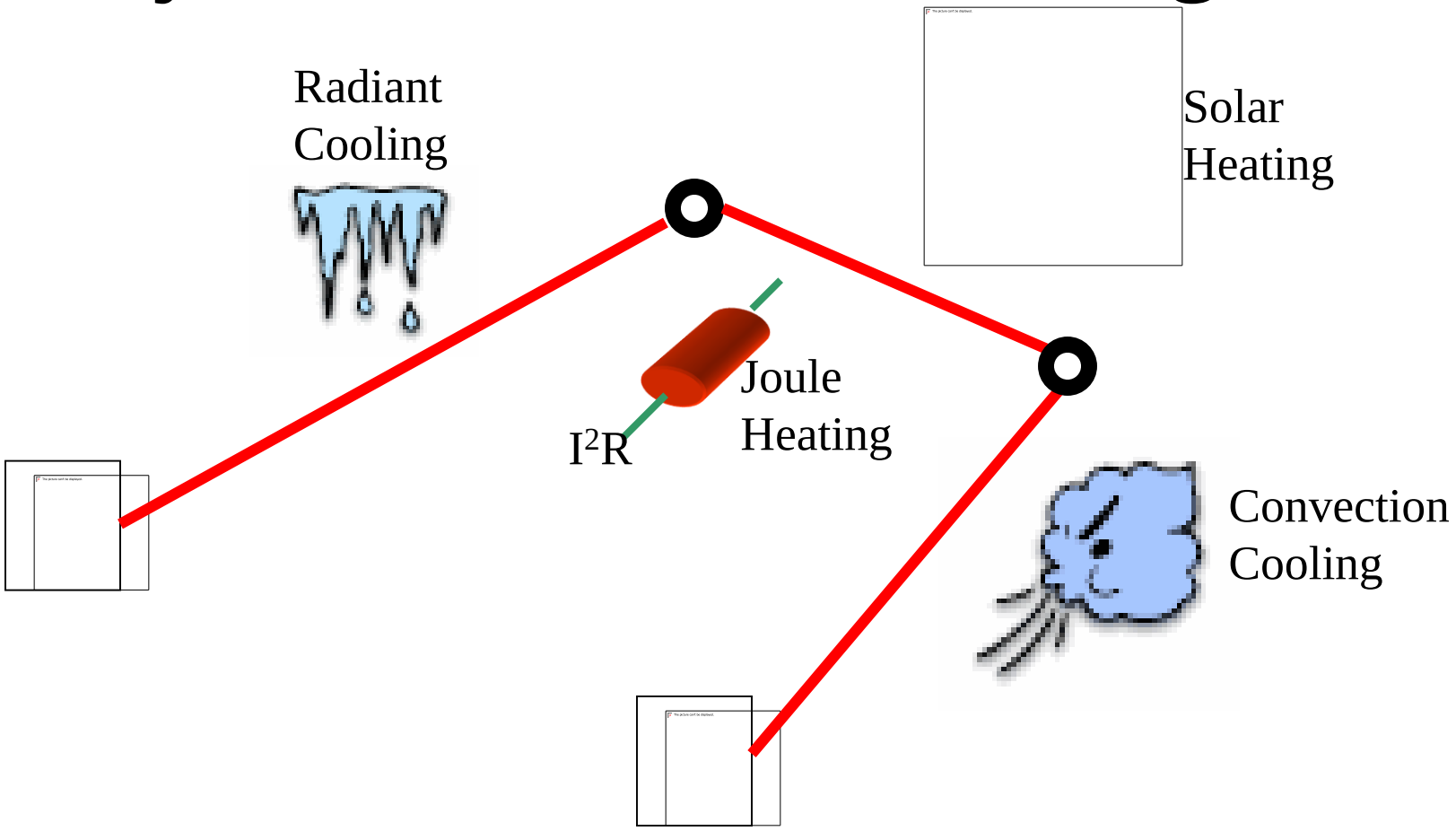
Dynamic Thermal Circuit Reliability

Problem: How to know what the true capacity of the transmission system?

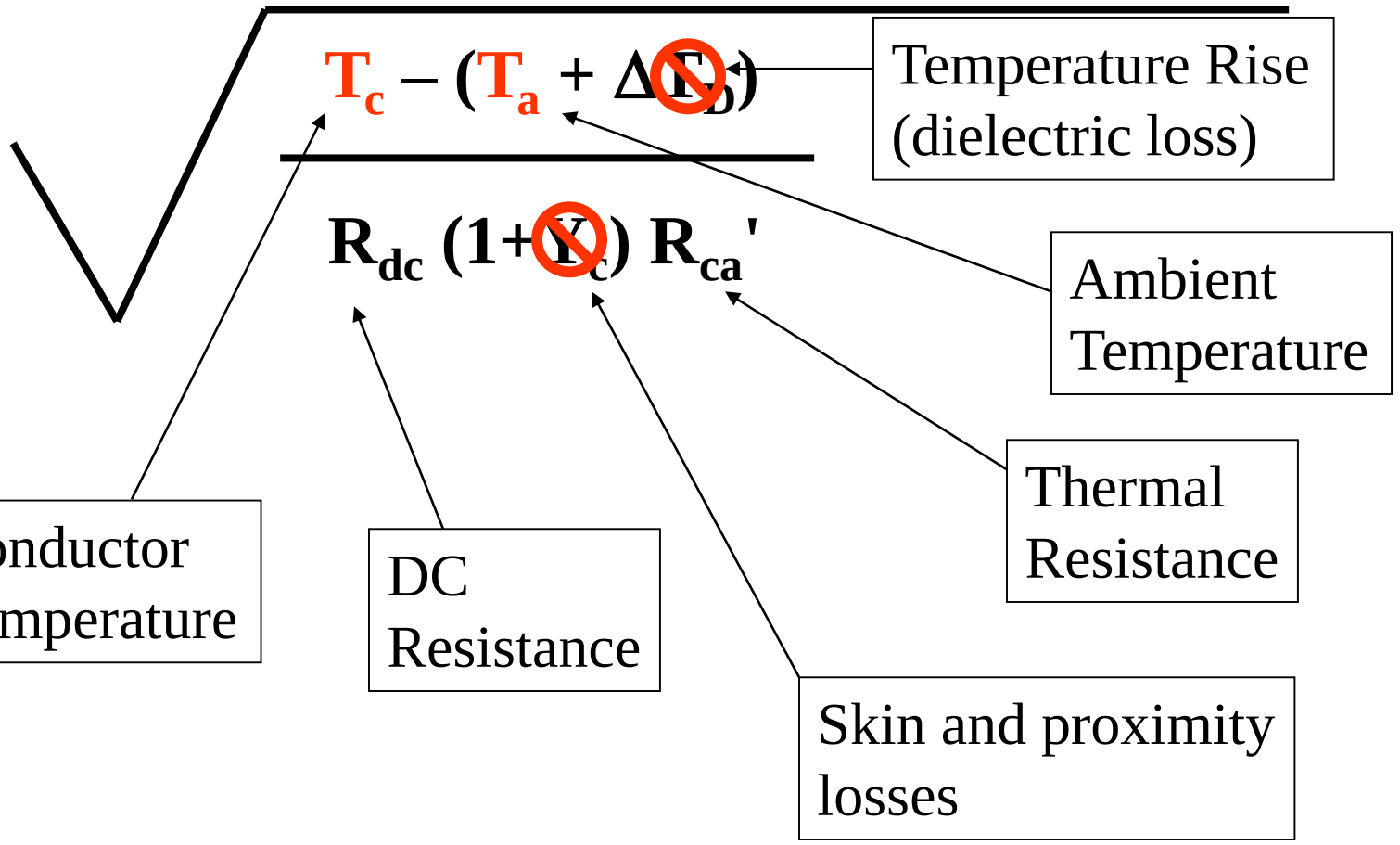


What is the true current carrying capacity of the transmission line?

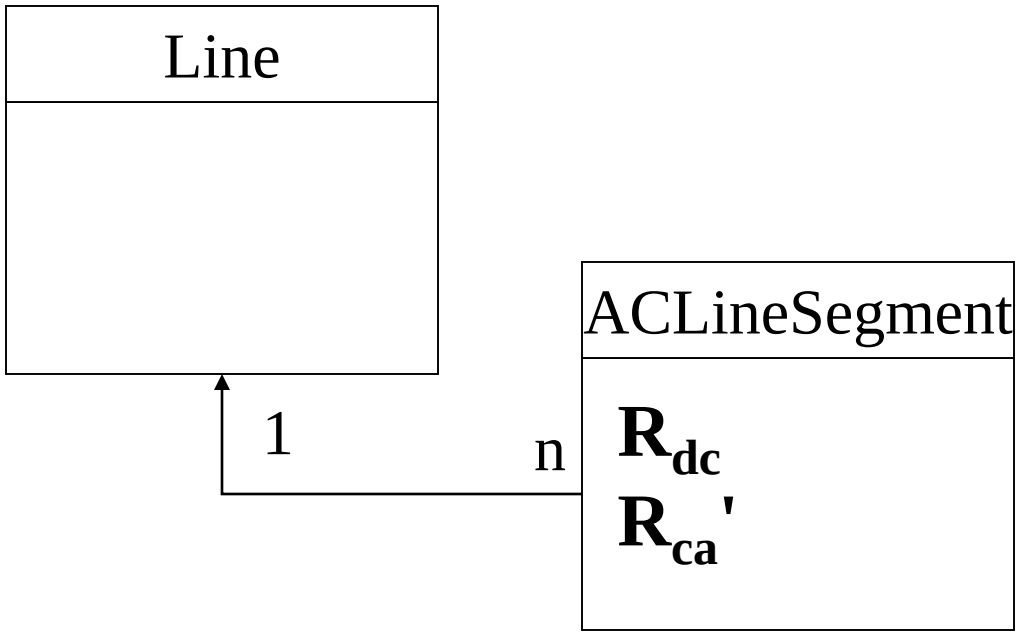
Physical Factors and Ratings



Steady State Ampacity Calculation (Neher-McGrath)

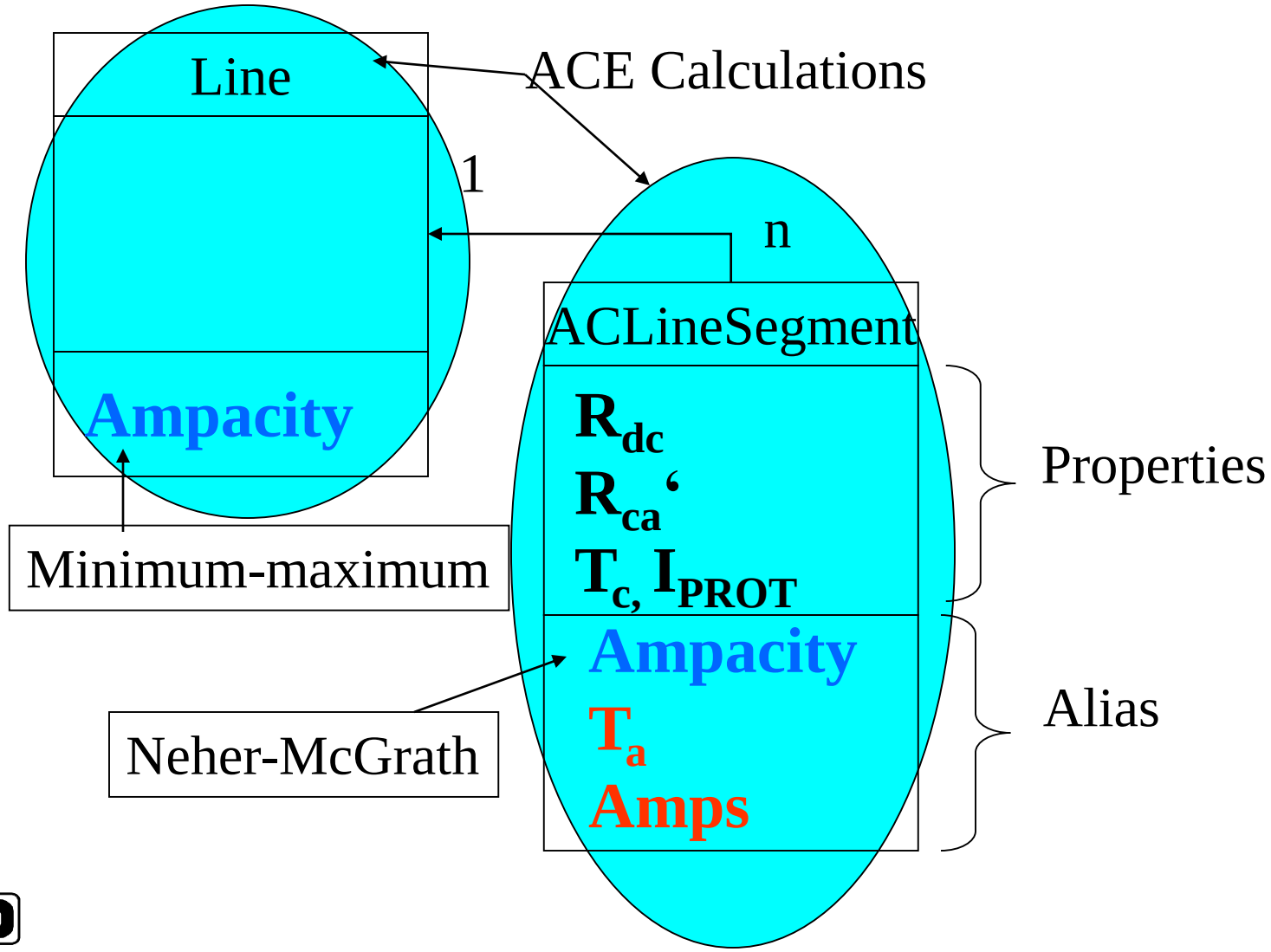


CIM has static information

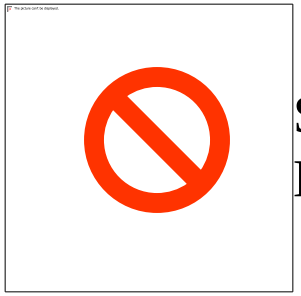
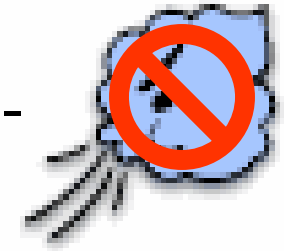


PI-Adapter can place CIM Schema in MDB

Modules have combined information

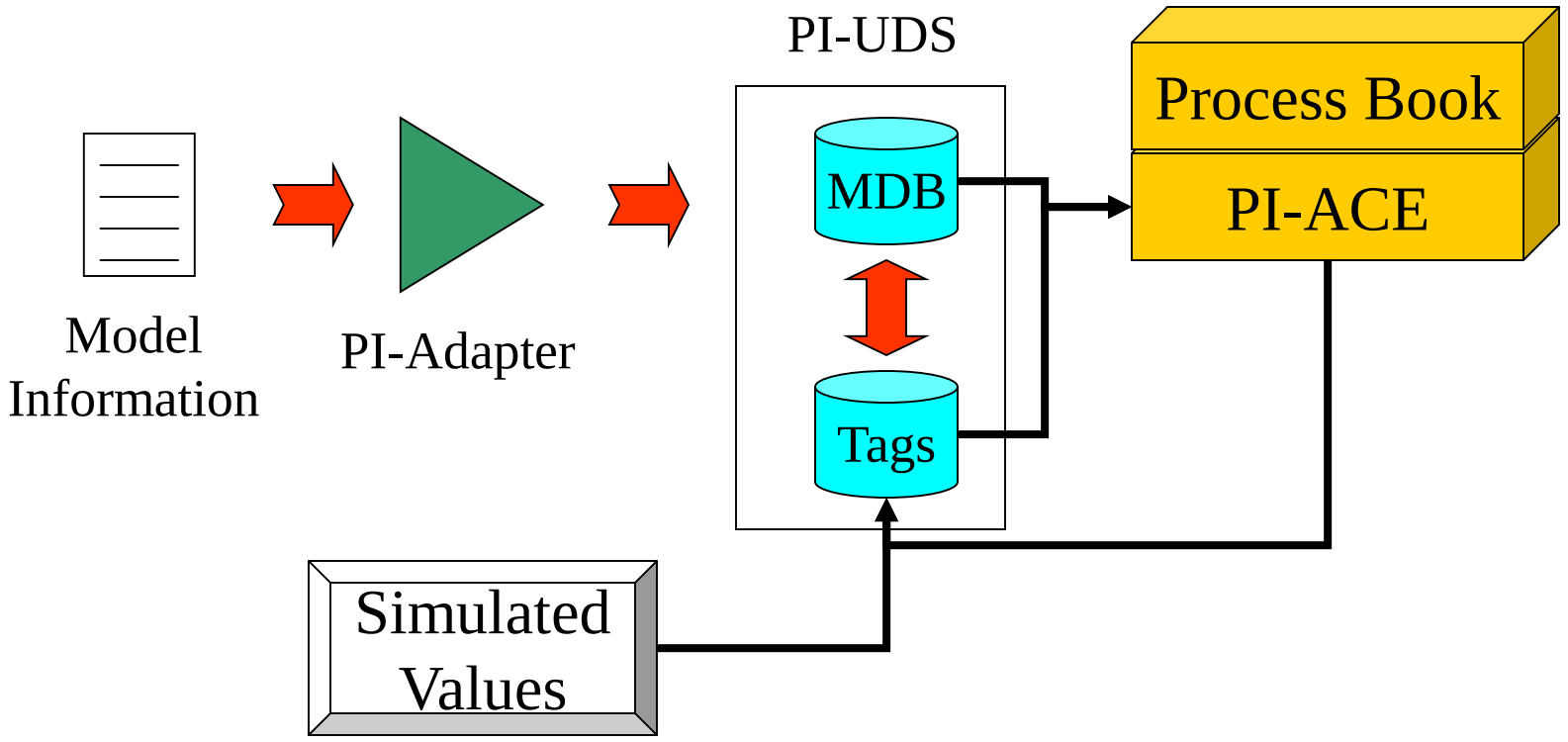


Adjusting Ambient Temperature

Ambient = (Actual +  Solar Heating) -  Convection Cooling

Rule: Ampacity < 0.95 * I_{prot}

Workflow


PI-UDS
Process Book
PI-ACE
MDB
Tags
Model
Information
PI-Adapter
Simulated
Values

Population of Model Results in:

Properties | Aliases | Associations

	Name	Value
0	InstanceOfClass	ACLineSegment
1	VerificationNeeded	TRUE
2	DeletionPending	FALSE
3	Naming.name	AIRP_TO_RIV_SEG_1
4	Conductor.bch	0.004
5	Conductor.r	1.172
6	Conductor.x	4.83
7	Conductor.MaxTemp	80
8	Conductor.ThermalResistance	0.25
9	IPROT	1000

R

T_c

R_{ca}

I_{PROT}

Properties | Aliases | Associations

	Name	Tag Name
0	Ampacity	AIRPTORIVER_SEGMENT1_AMPACITY
1	Amps	AIRPTORIVER_SEGMENT1_AMP
2	Temperature	AIRPTORIVER_SEGMENT1_TEMP

ACE Calculated Ampacity

T_a

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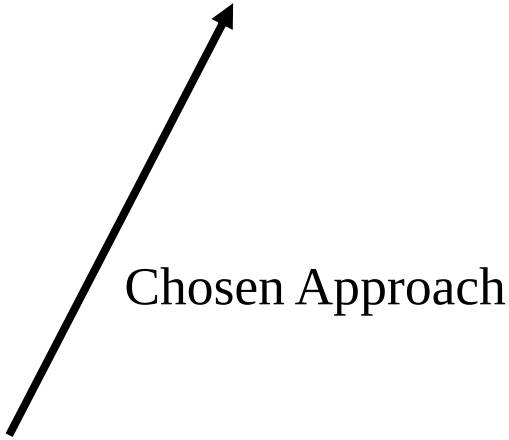
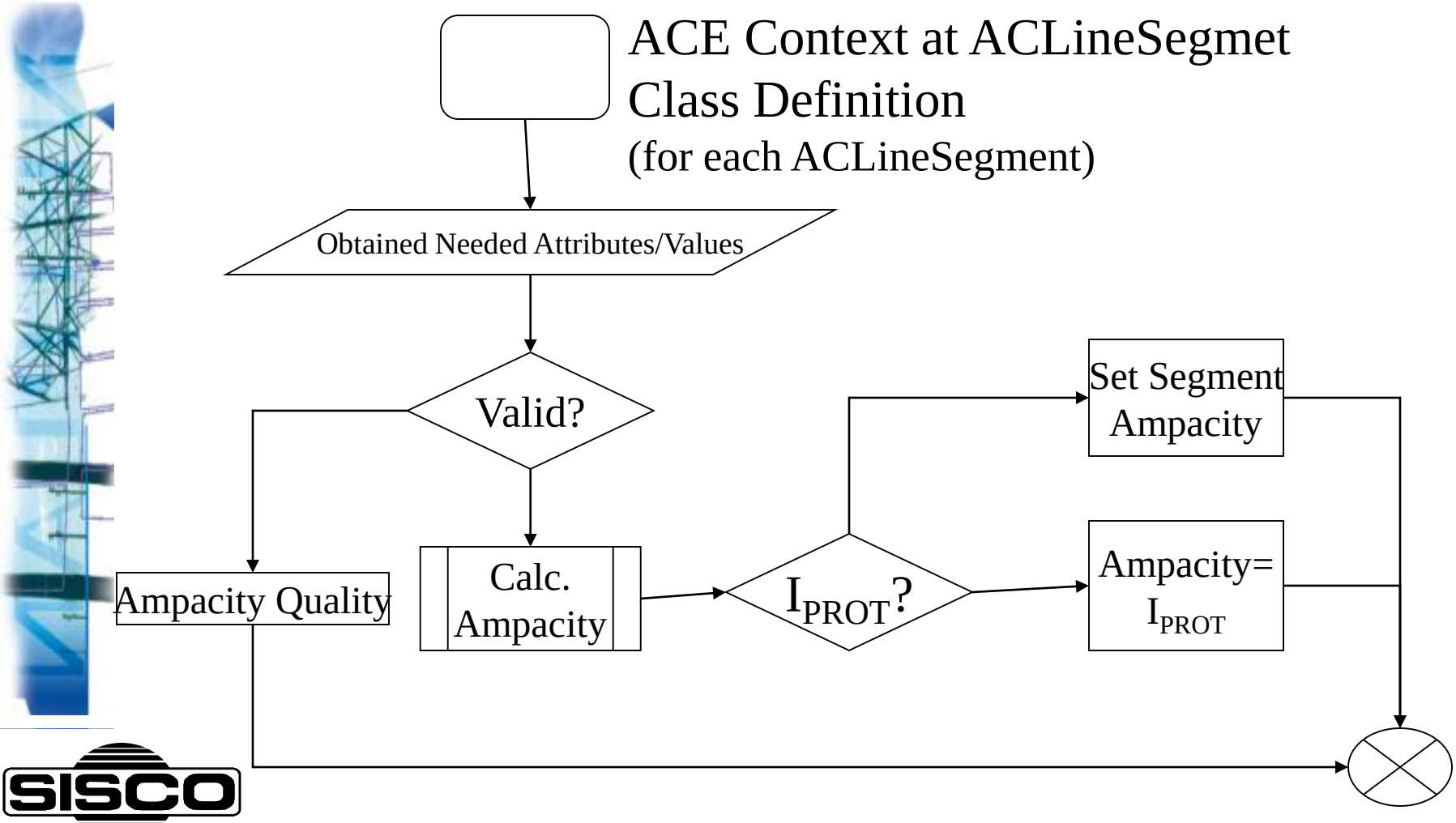
ACE Design Question

- Design based upon modules?
  - Context configuration issues arise.
  - Synchronization issues arise.
- Design based upon class/instance relationships?

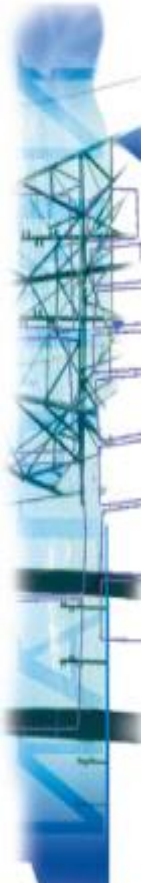


Desire is to have calculations auto-run when new line segments are added.

General ACE Algorithm



Issues Encountered



- Which Interface?
- Forgetfulness
- Logging

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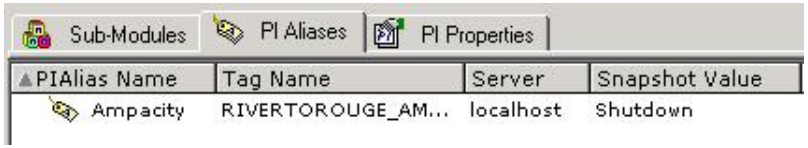
Which Interface?

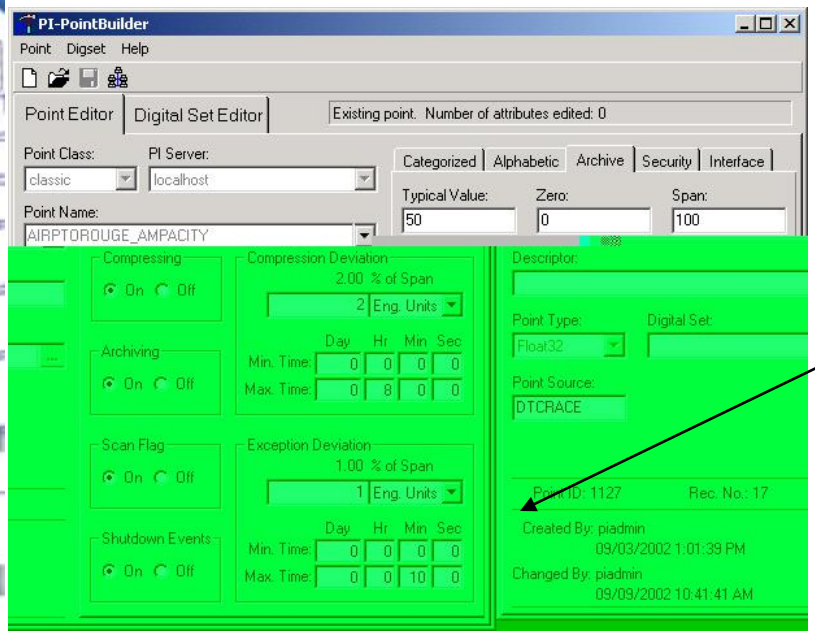
- Ampacity tags and aliases are calculated only.
- Need to be configured as “output” tags, but have no real interface.
- Decided to create a virtual interface DTCRACE.

Forgetfulness

- Debug of ACE calc was OK…
- Checked security settings…OK…
- What else?

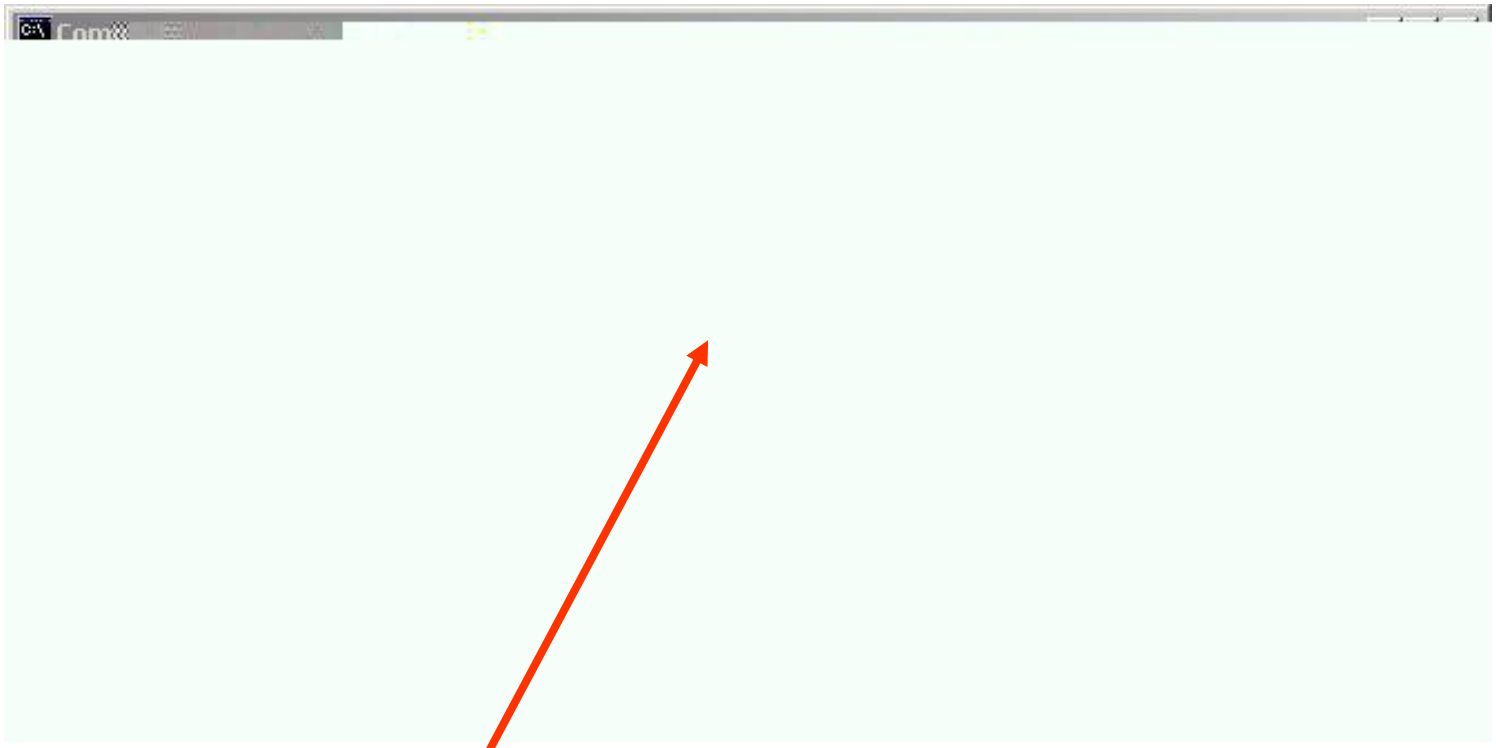


Forgetfulness



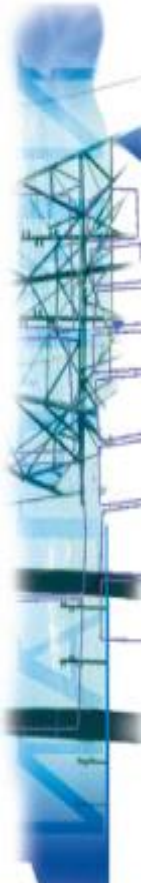
- Calculated tags are "output" tags.
  - Must turn off "shutdown" events for output tags.

LogPIACEMessage Logging



Difficult to read….need alternate mechanisms.

Logging Options



- Do Nothing
- Files
- Use a PI Tag

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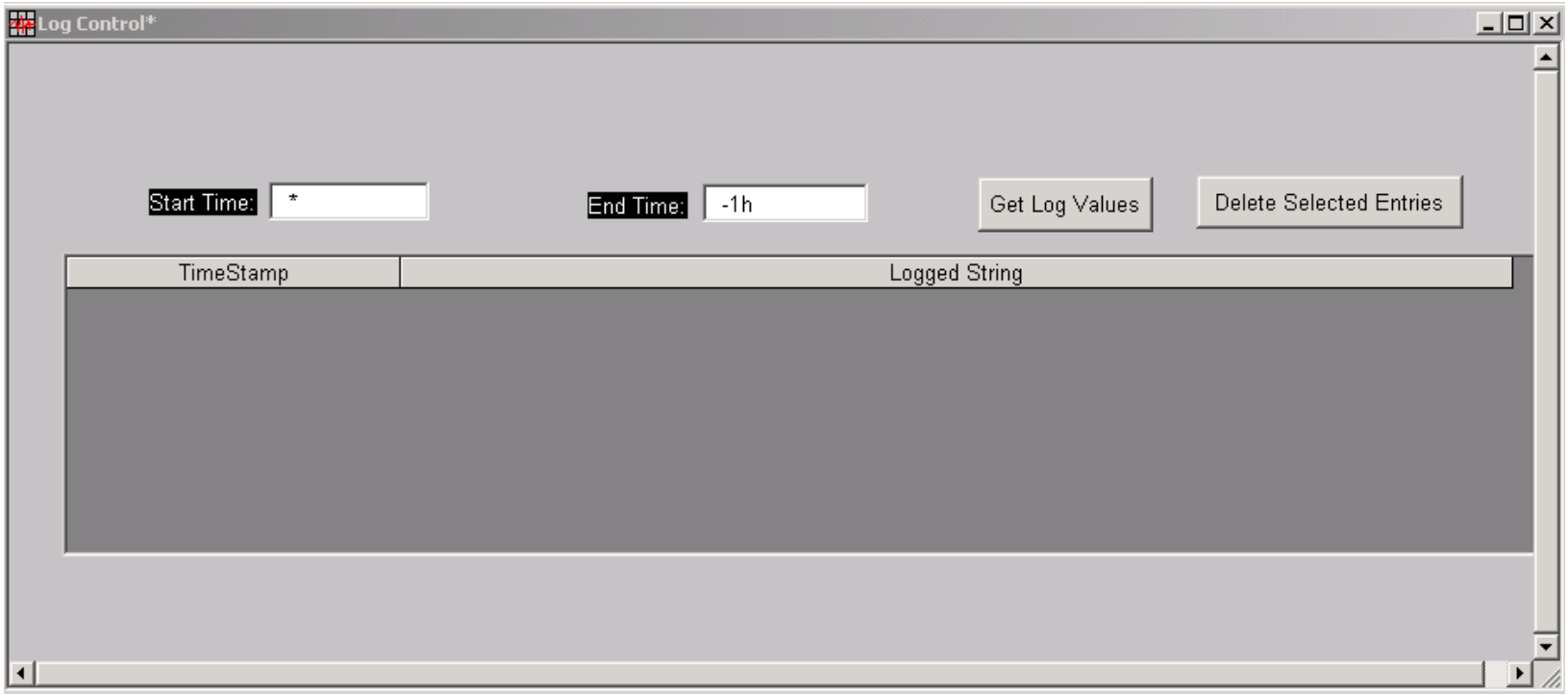
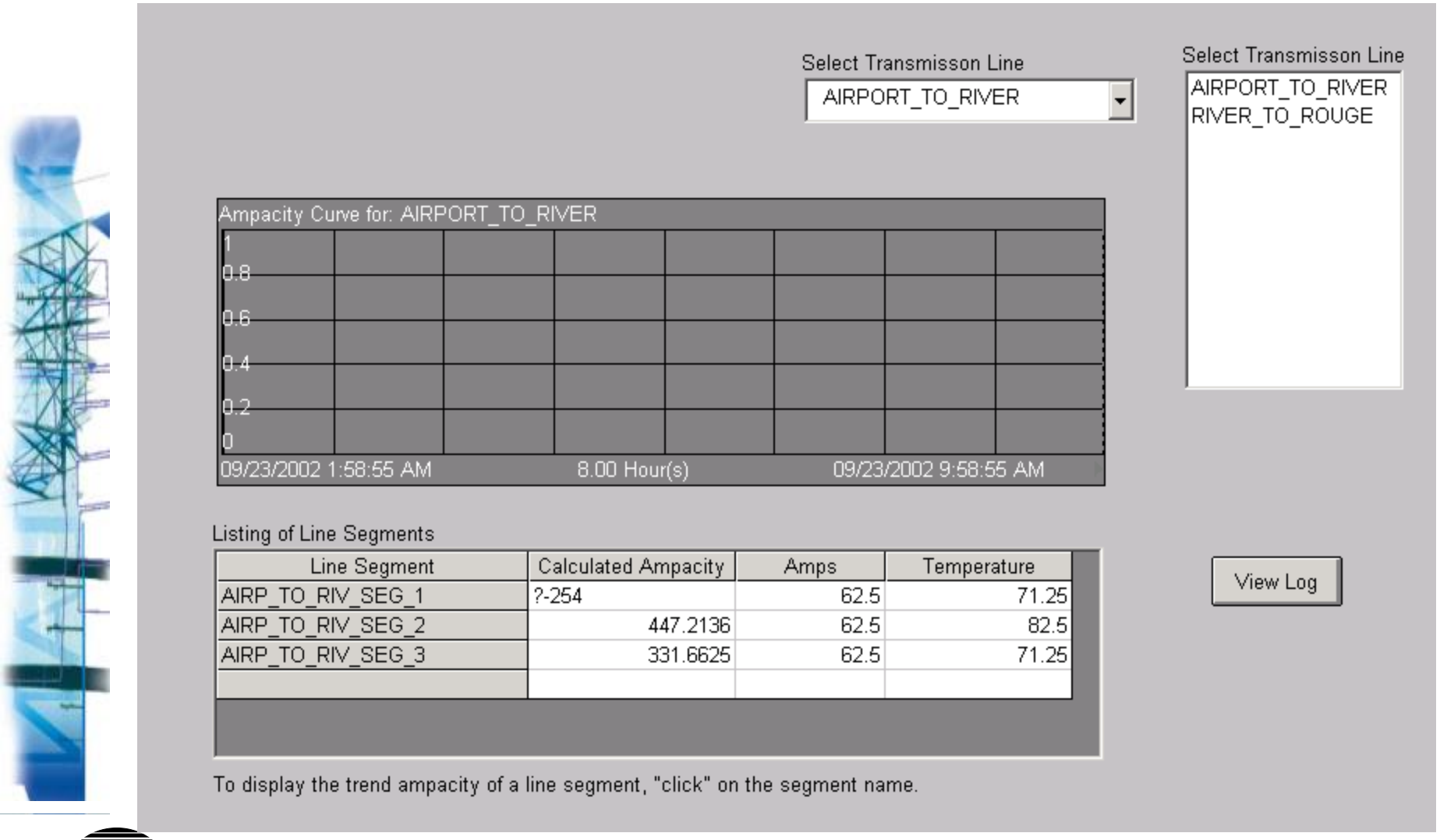
Log Display


Log Control*
Start Time:
*
End Time:
-1h
Get Log Values
Delete Selected Entries
TimeStamp
Logged String

Making ProcessBook Model Aware



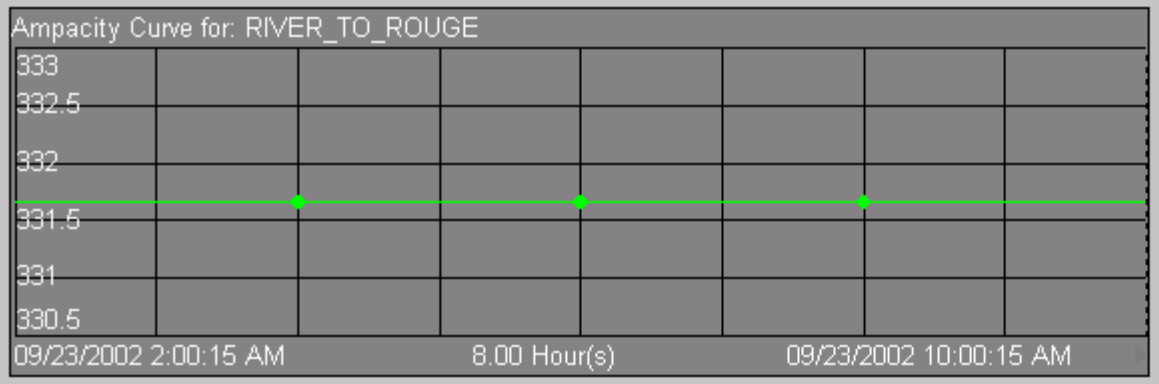
Same Display, different Substation

Select Transmisson Line

RIVER_TO_ROUGE

Select Transmisson Line

AIRPORT_TO_RIVER
RIVER_TO_ROUGE



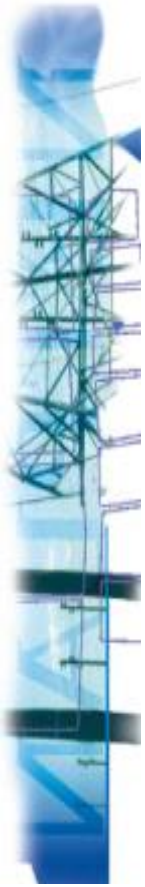
Listing of Line Segments

Line Segment	Calculated Ampacity	Amps	Temperature
RIVER_TO_ROUGE_SEG_1	331.6625	70	100
RIVER_TO_ROUGE_SEG_2	447.2136	70	100
RIVER_TO_ROUGE_SEG_3	331.6625	70	100
RIVER_TO_ROUGE_SEG_4	331.6625	70	100
RIVER_TO_ROUGE_SEG_5	331.6625	70	100

View Log

To display the trend ampacity of a line segment, "click" on the segment name.

Benefits of Having ACE and PB Model Driven



- As model changes, both are synchronized:
  - Errors corrected, calculations automatically detect.
  - As model is changed (e.g. adding a new line segment)
    - Calculations adapt
    - PB display adapts

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Future Benefits

- Application Framework may allow “auto-generation” of displays/one-lines.