

# The next level BIM electrical : Embedded analysis using REVIT API

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# About Me...

Ahmed Attia, LEED GA, P.E.

- License professional engineer in Colorado
- Certified LEED Green Associate
- 8 years as an electrical design engineer
- 3 years as a BIM Specialist
- Senior electrical engineer - BIM specialist for DAR AL HANDASA, Egypt
- working on developing electrical BIM workflows, with a focus on electrical analysis and BIM for sustainability



# Dar Al-Handasah

- Is a *multidisciplinary* consulting organization, It was established in 1956
- It operates in *40 offices* in the Middle East, Africa, Asia and Europe with *five design centers* in Beirut, Cairo, London, Pune and Amman.





# Class Summary

In this class I will be discussing how Revit should be moved from being a drafting tool into being a central platform for design and engineering, that can perform analysis tasks directly in model leading to an integrated workflow.

I will discuss why MEP is still struggling to reach closed loop BIM design workflow, what is wrong with our current design workflow, how to develop our own process and how we at DAR developed a methodology and move to more optimized workflow.



# Key Learning Objectives

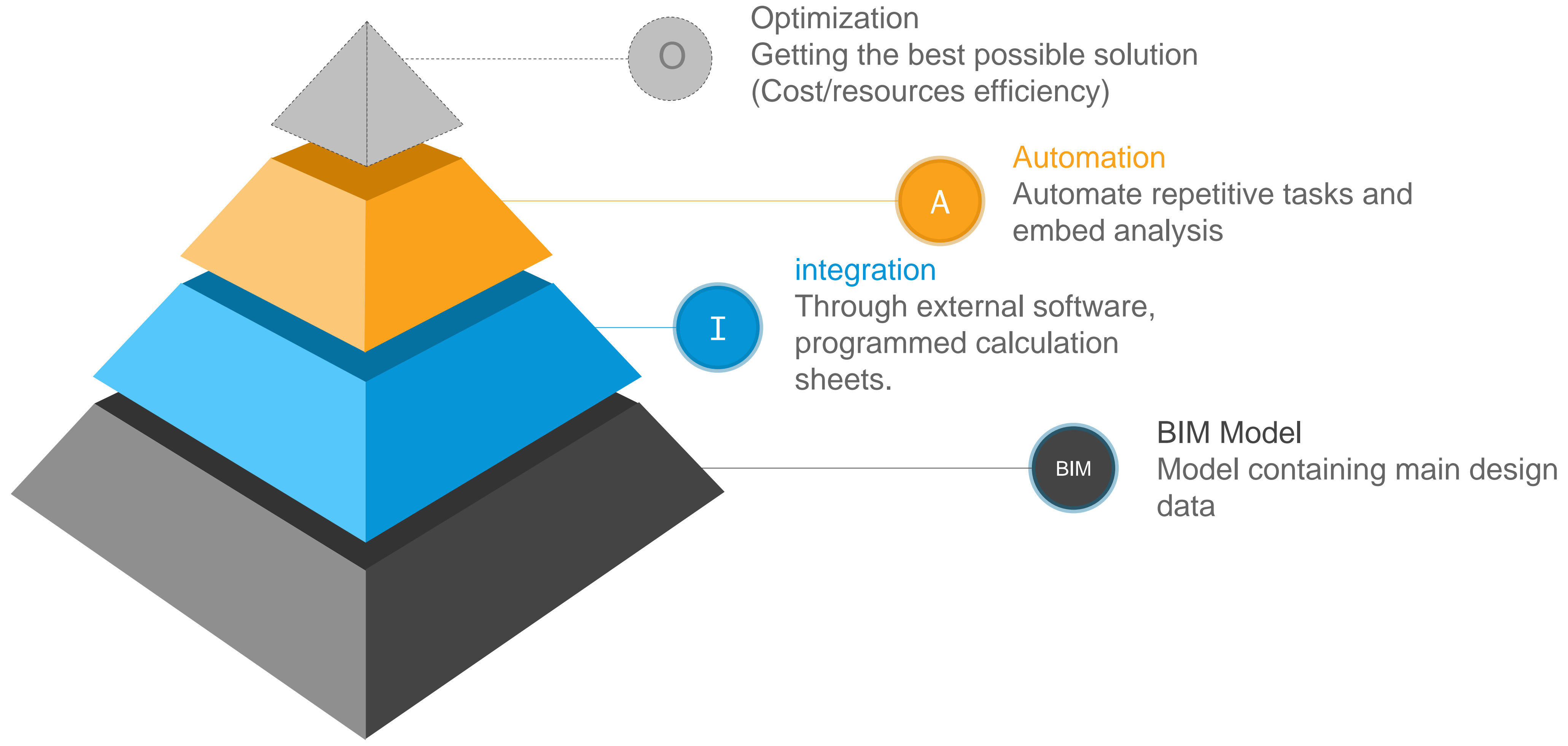
At the end of this class you will be able to:

- Follow a systematic approach to embed analysis inside Revit
- Understand how to utilize an external database to store data needed for analysis
- Understand how to introduce custom calculation settings inside Revit
- Get introduced to some useful API capabilities

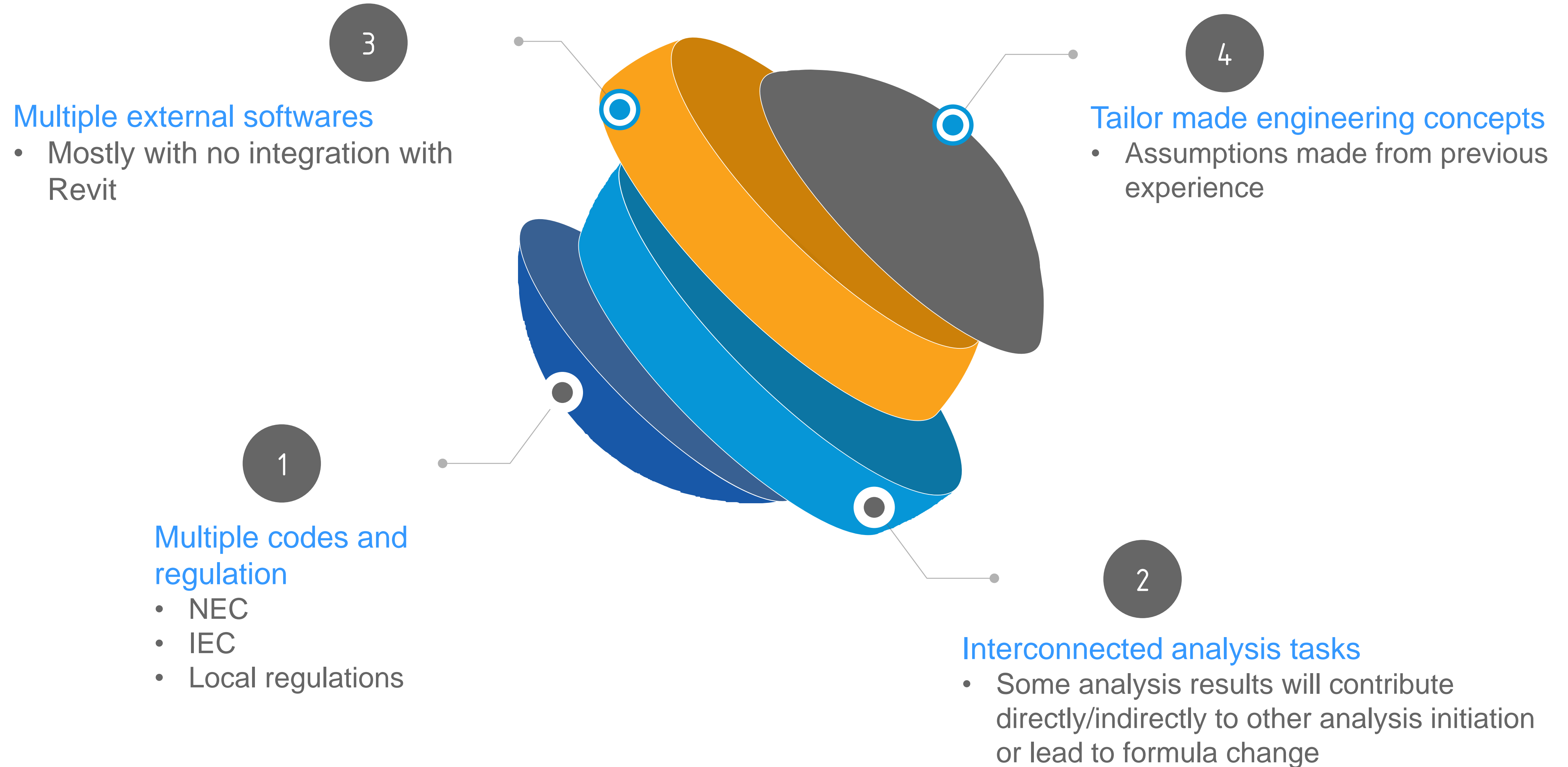
**Who are you?**

# Where are we and where to?

Technology gives many options



# Why are we stuck with analysis?

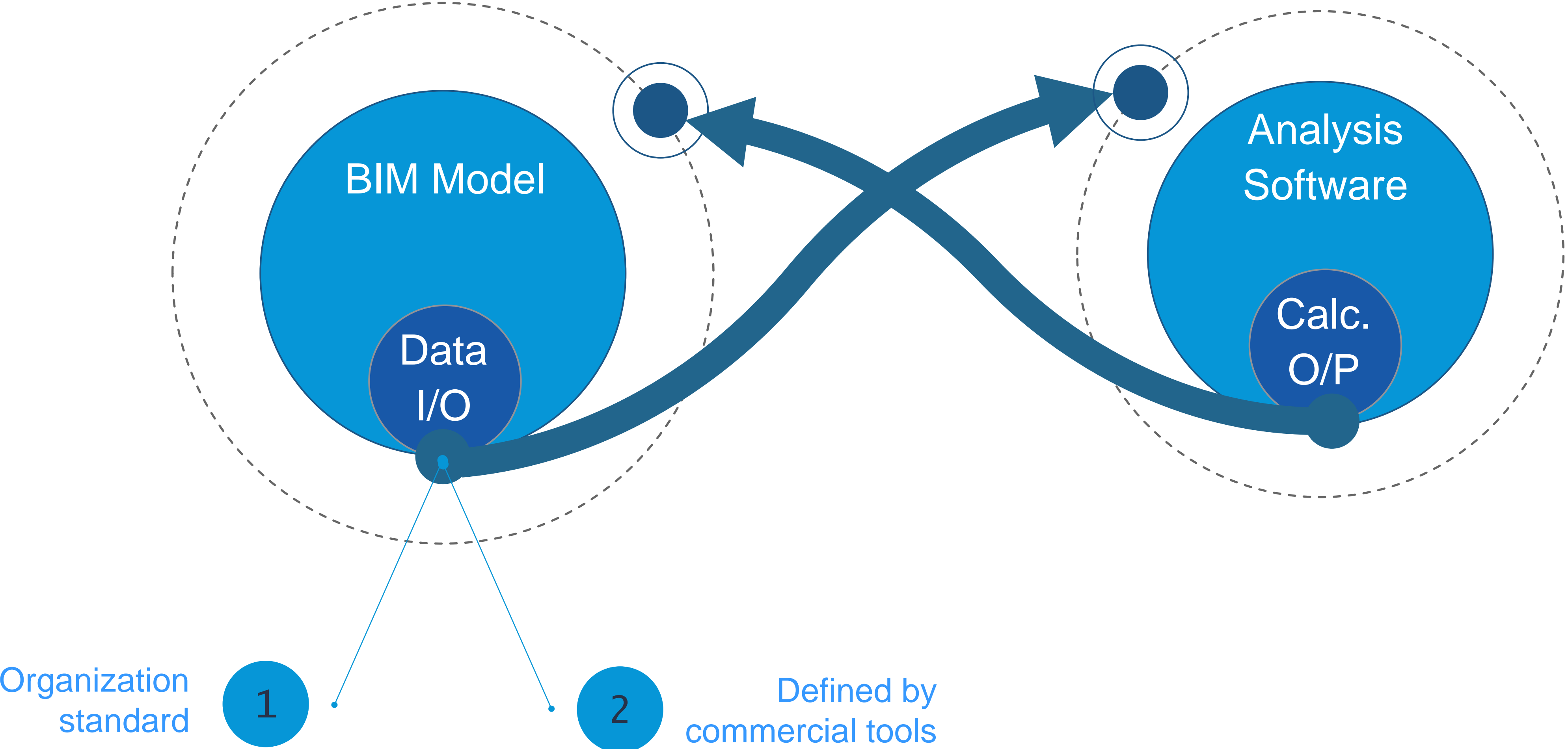




# **Drawing the path**

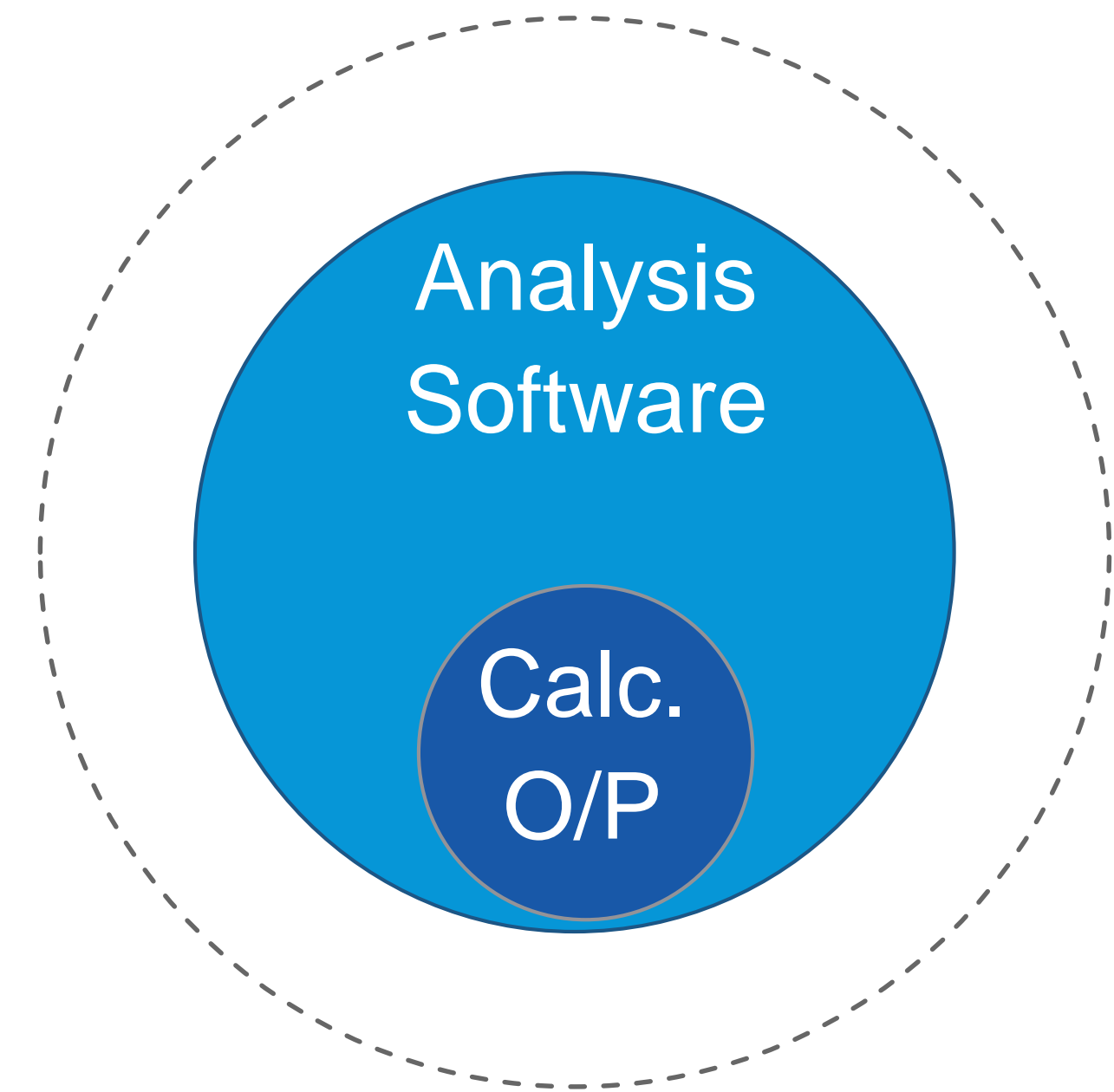
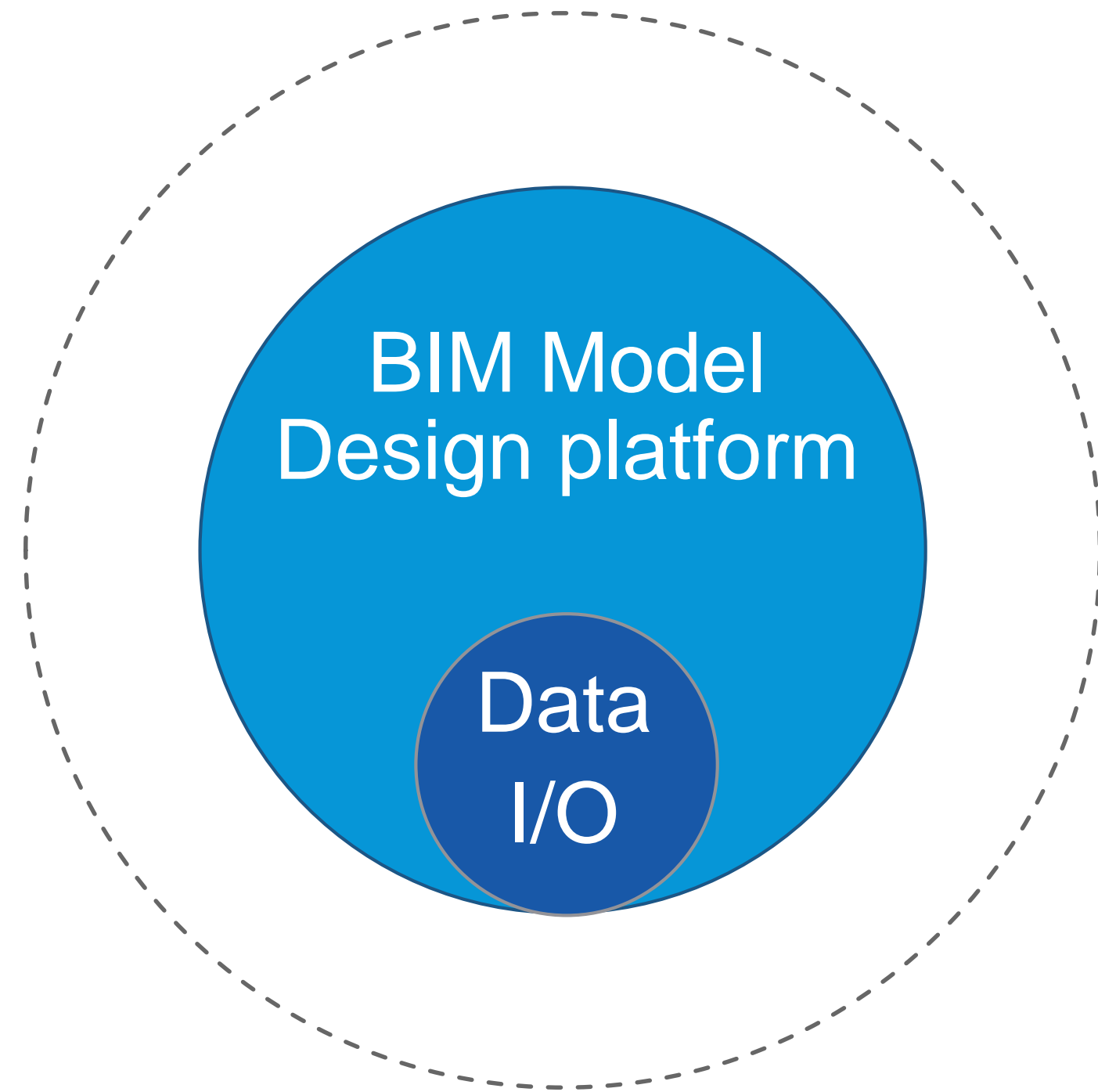


# Planning the new process

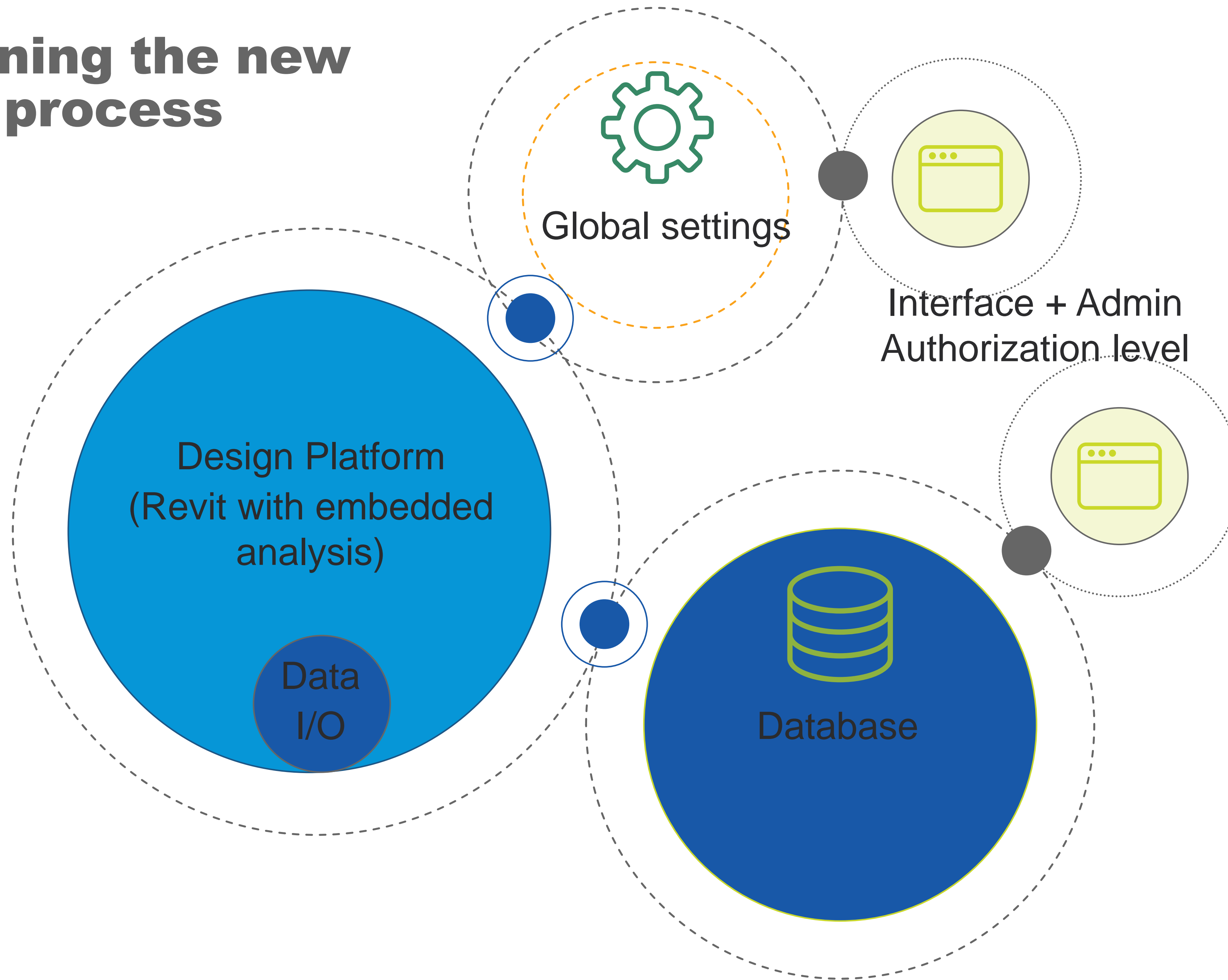




# Planning the new process



# Planning the new process

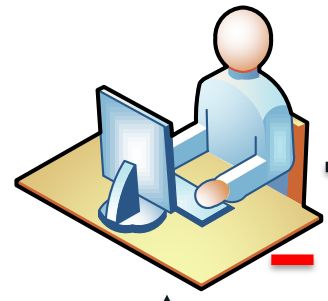




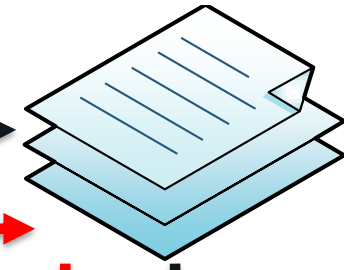
# Data exchange process



Electrical engineer  
perform electrical  
analysis



Design Change

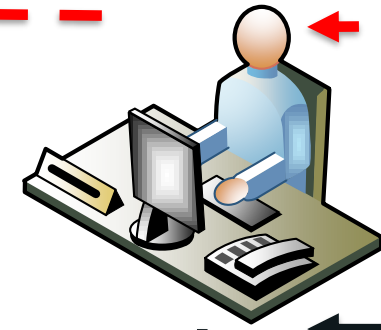


Calculation  
results

MCC schedule  
tabulation

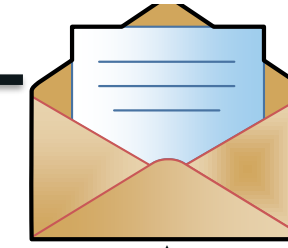


Electrical Engineer



Request mechanical loads sheets

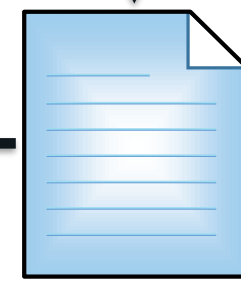
Design Change



Mechanical  
Engineer

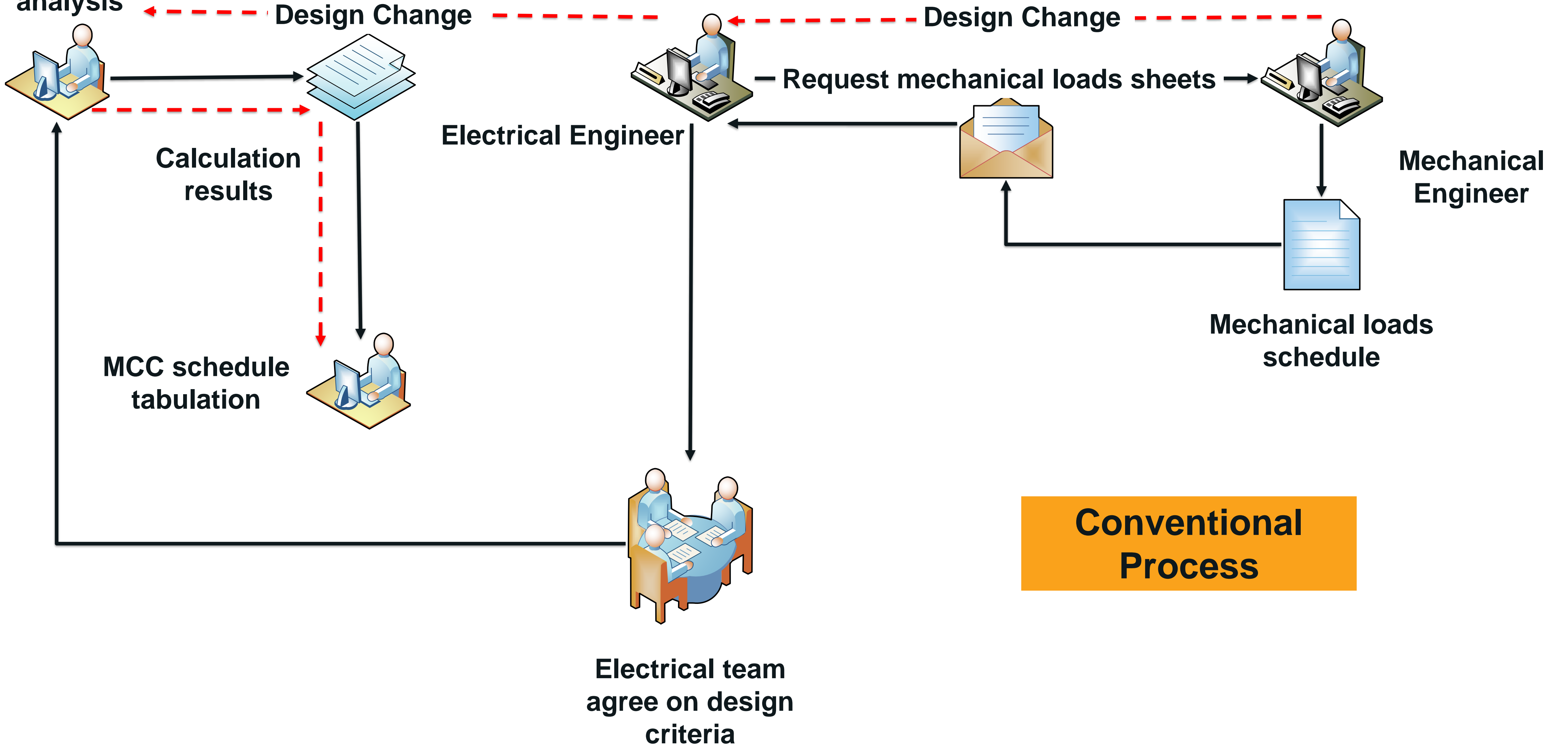


Mechanical loads  
schedule

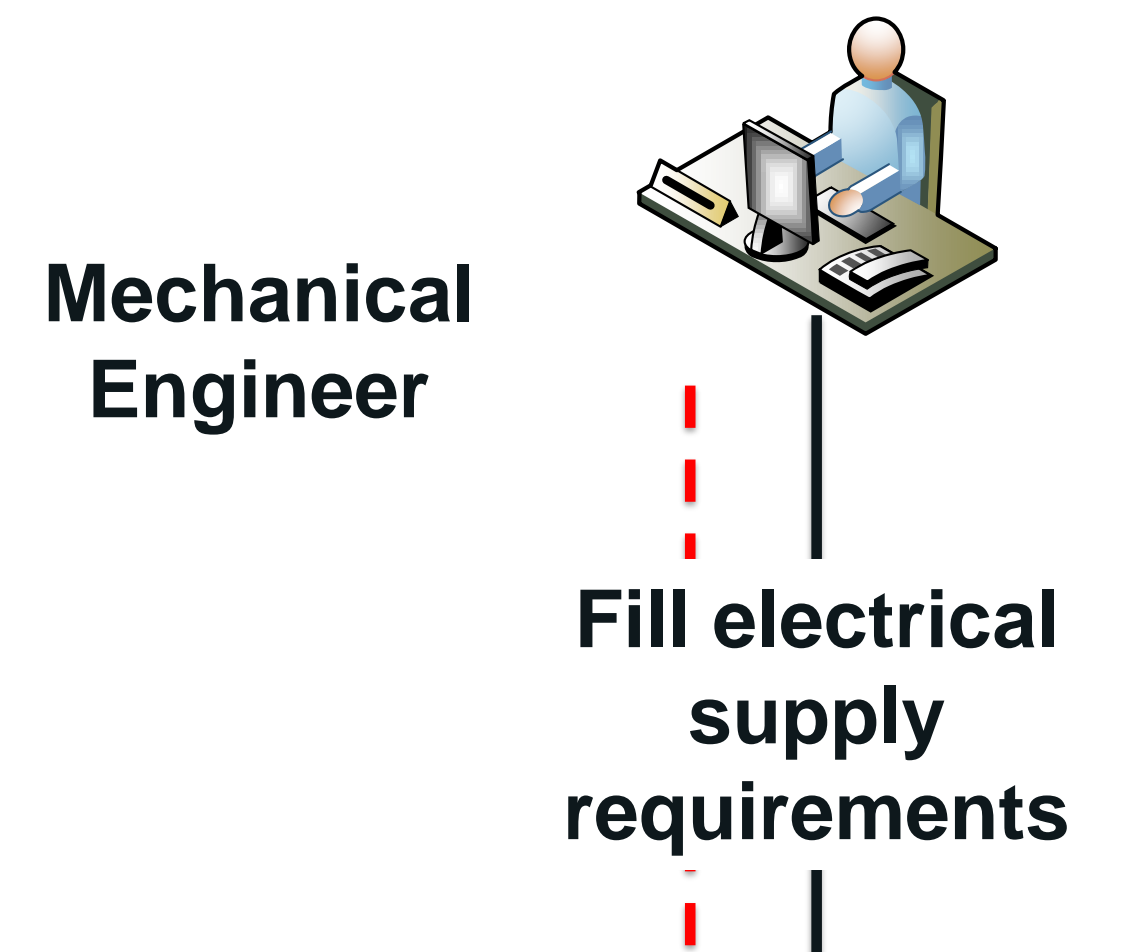
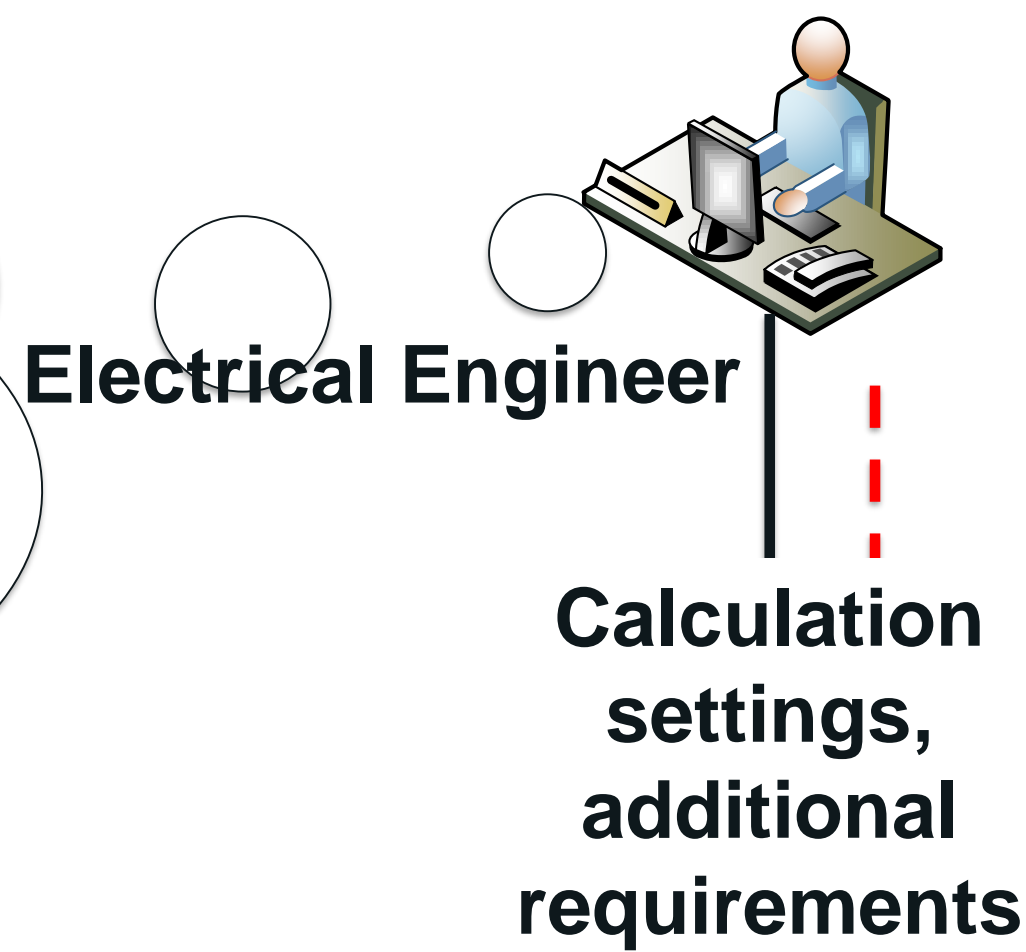
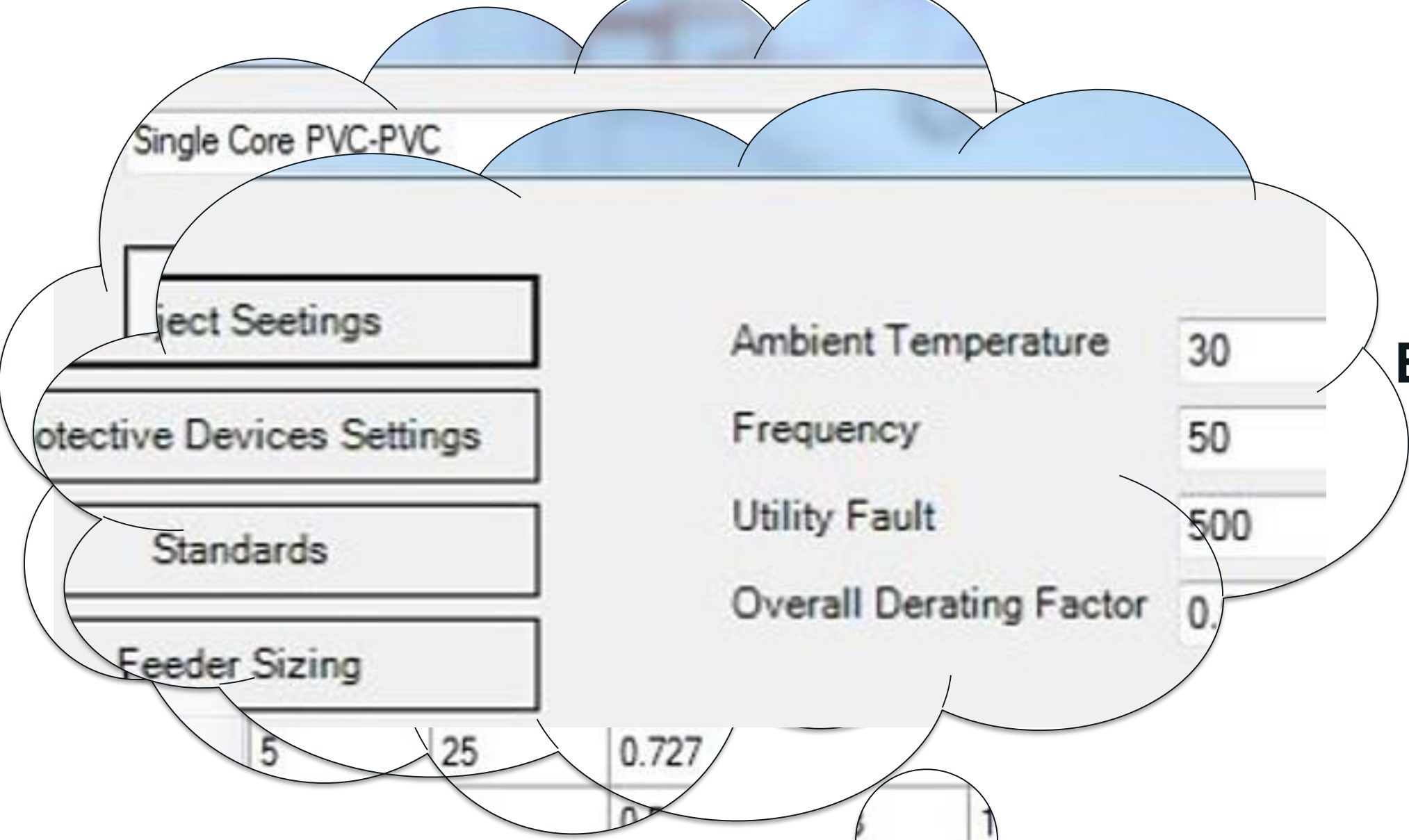


Conventional  
Process

Electrical team  
agree on design  
criteria

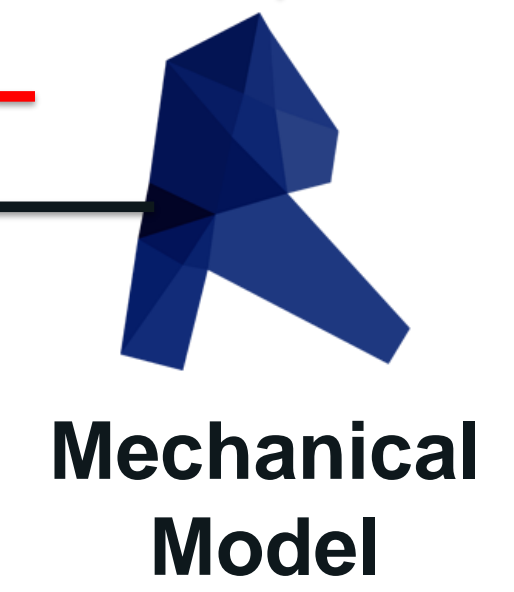
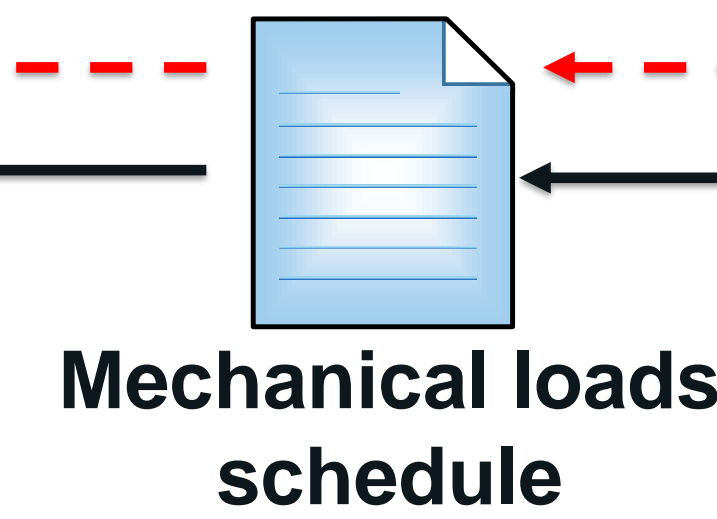
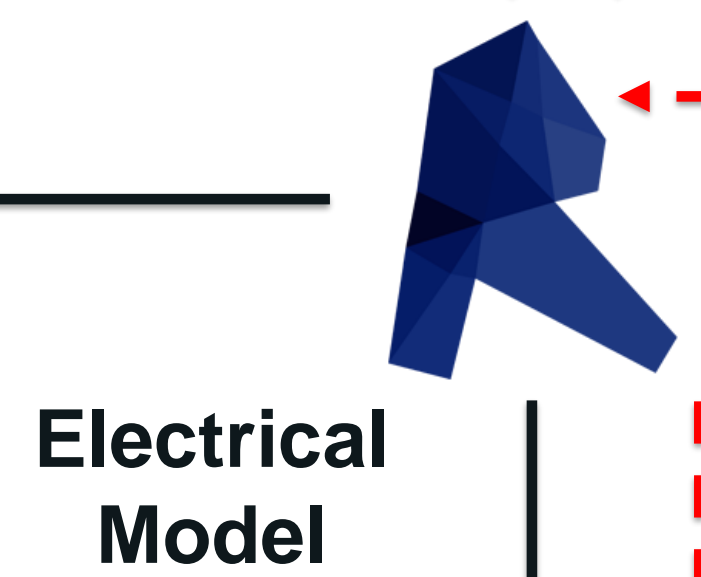






Data			Branch Circuit			
No Of Phases	Rated O/P Power	AMP	Type	size mm2	Length	
3	22	35.324342	CU/XLPE/LS0H 3C+1C(E)	16+16 (E)	42.1	
3	18.8	27.16763	CU/XLPE/LS0H 3C+1C(E)	16+16 (E)	32.9	
3	18.8	27.16763	VFD CABLE 3C+3C(E)	25+16 (E)	48.6	
3	18.8	27.16763	VFD CABLE 3C+3C(E)	25+16 (E)	100.4	

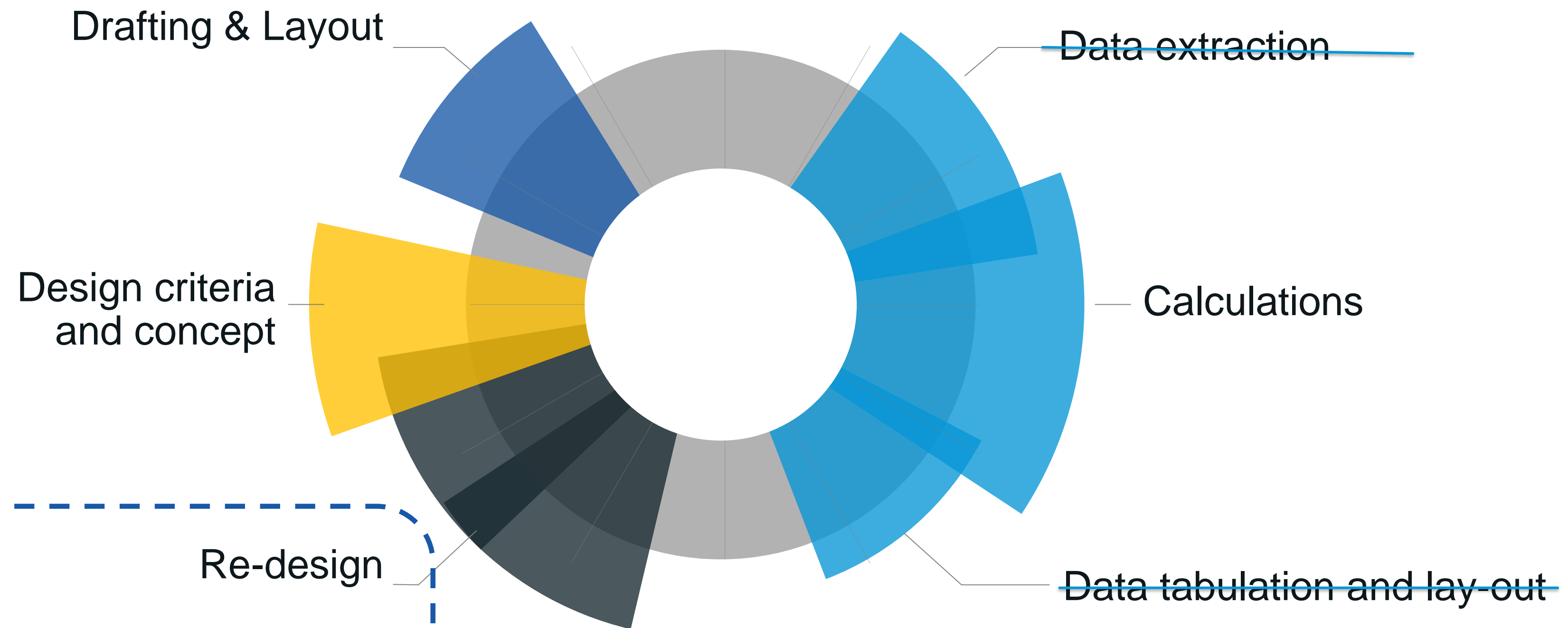
er data, settings



**MCC Schedules**

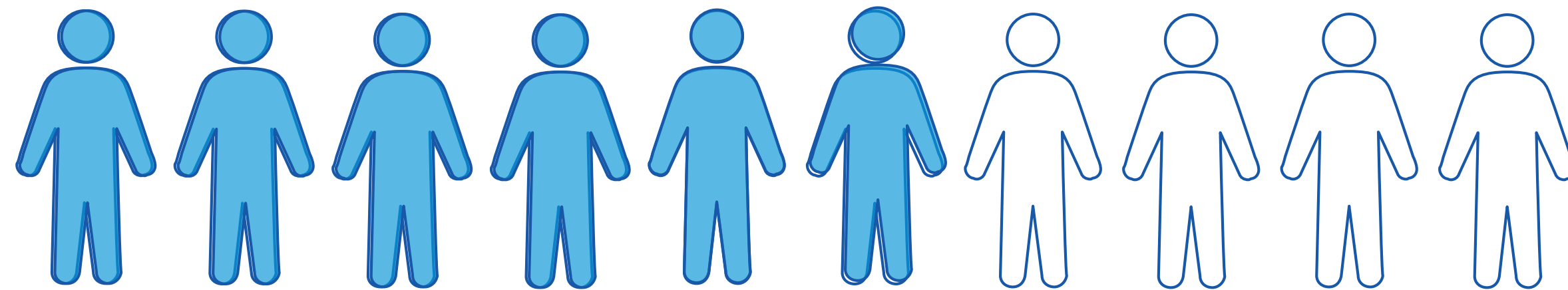
**Optimized Process**

# Engineering design process optimization





# How much a single platform can save me (Resources/Manhours)



**6 of 10**  
Engineers/Manhours

# Steps to implementation

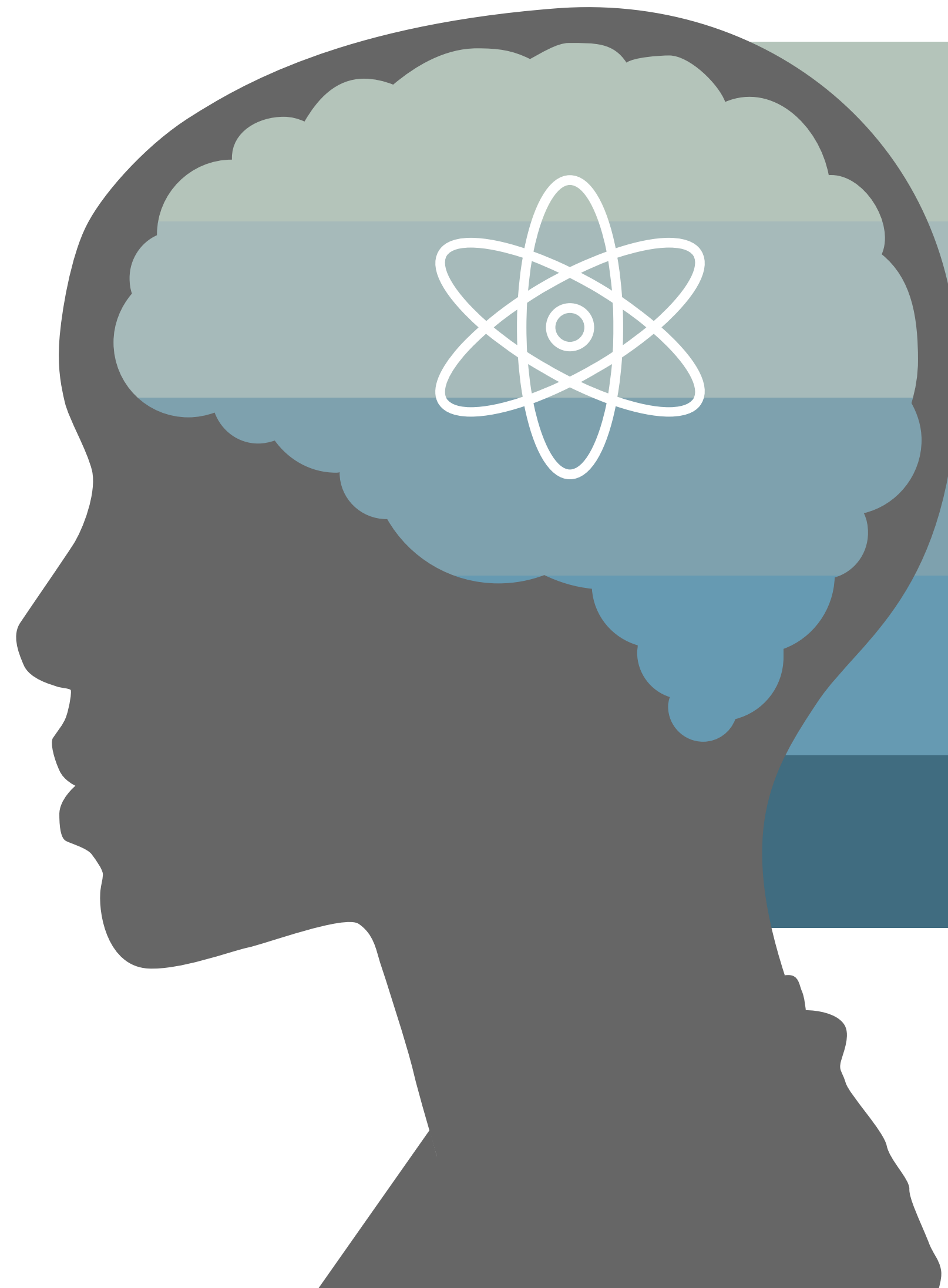




**“It’s not about coding or tools, its  
about methodology”**

The background features a complex geometric pattern of blue and white lines. A prominent feature is a series of parallel, slightly curved lines that create a sense of depth and perspective, resembling a stylized architectural structure or a data visualization. The overall aesthetic is clean, modern, and technical.

# Electrical analysis integration Methodology



- 01 Break analysis Into a software friendly structure
- 02 Standardizing BIM objects (Families ,Templates)
- 03 Create your flow chart
- 04 Create analysis database
- 05 Design custom user interfaces



# 01 -Break analysis Into a software friendly structure

A

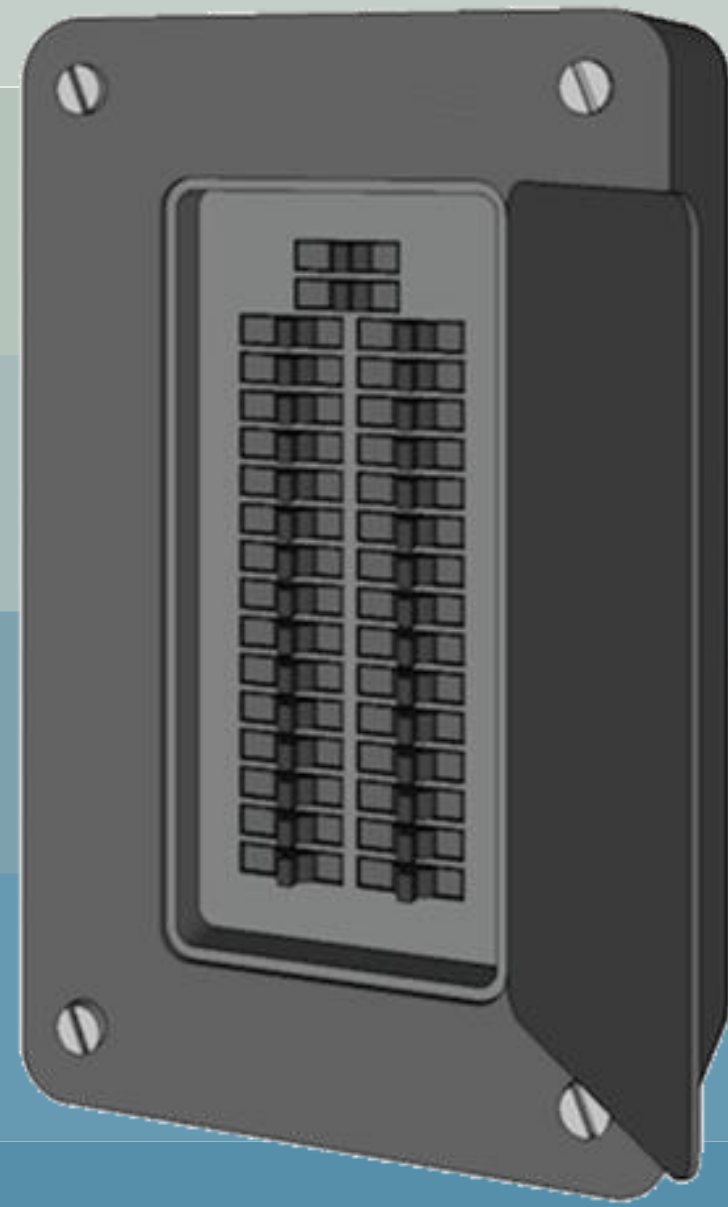
B

C

D

E

F



Determine target analysis  
Short circuit? , Equipment sizing?



Global Settings  
Voltage levels, Derating factors, Utility fault



Calculation References (Database)  
Cable sizes, Trip ratings, % impedances



Identify analysis Inputs  
Loads(normal, emergency, life safety),Demand factors.

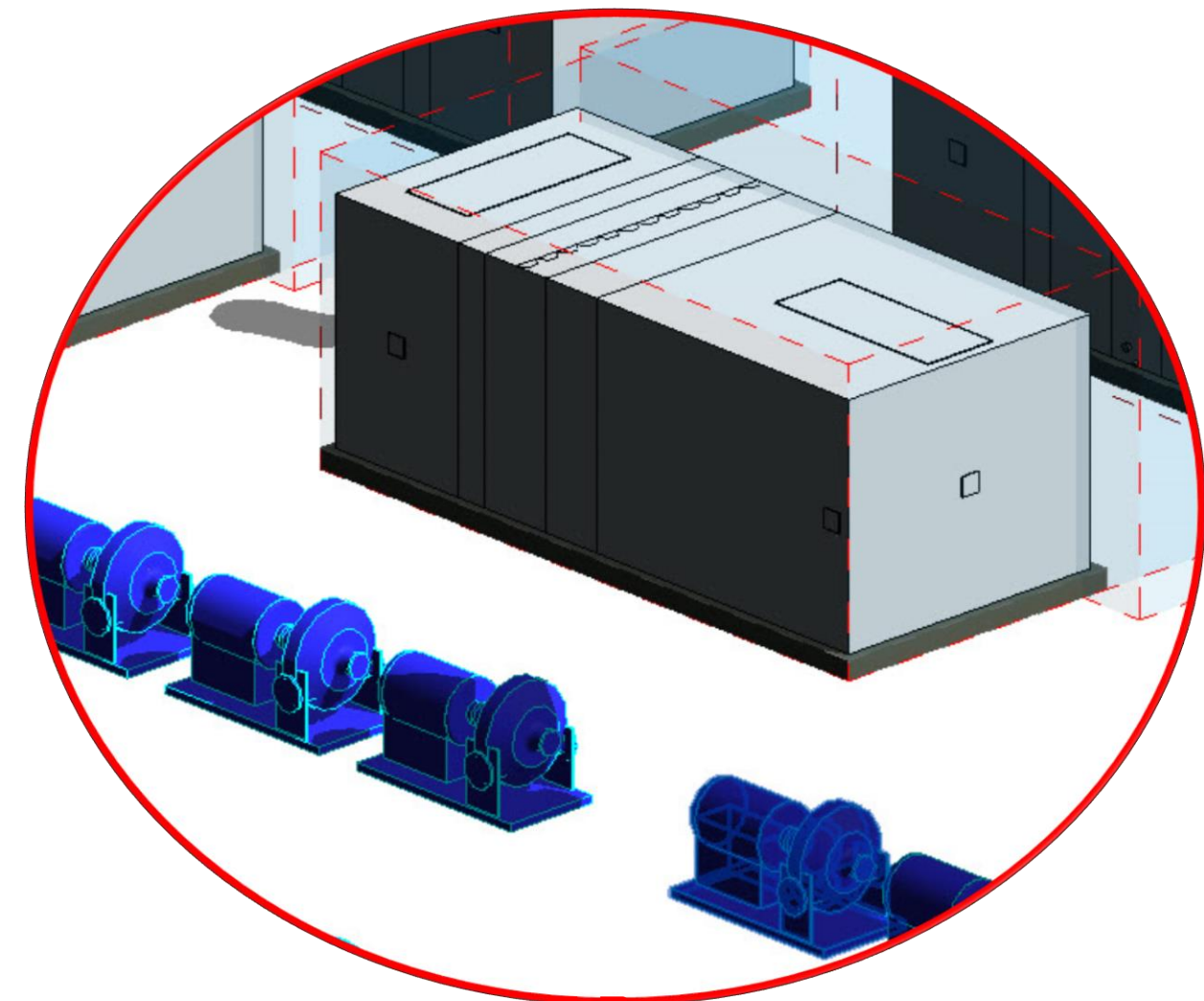


Identify analysis outputs  
Breaker rating, Short circuit level, total loads

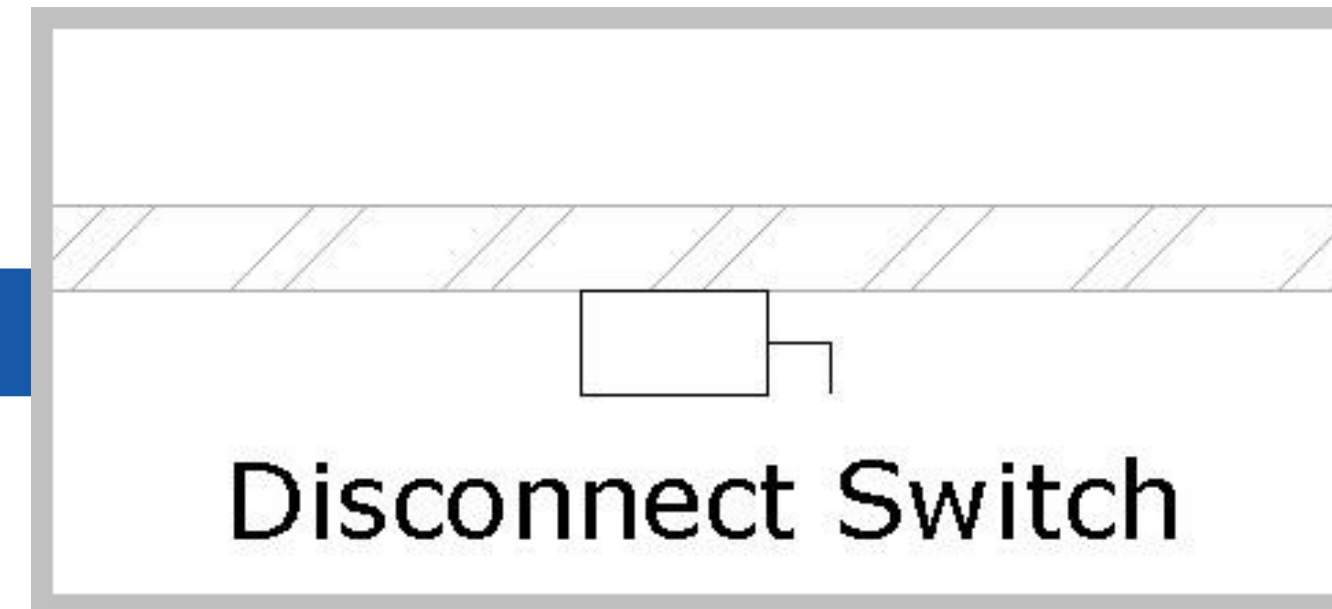


List of formulas  
 $P = V * I * \text{Cos } \Theta$

# 2-Standardizing BIM objects (Families, Templates)



Analysis  
Input parameters



Analysis Output  
parameters

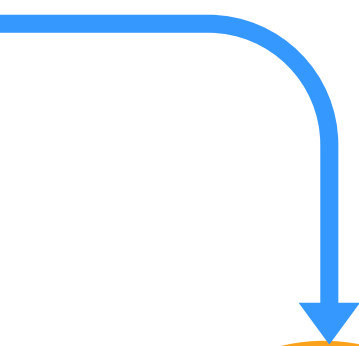
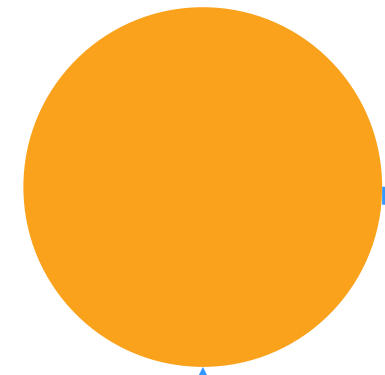
Equipment Rating	24 kW	<input type="checkbox"/>	<input type="checkbox"/>
Starter	VFD	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Duty/StandBy	Duty	<input type="checkbox"/>	<input type="checkbox"/>
Life Safety	Yes	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>

D.S. rating	80 A	<input type="checkbox"/>	<input type="checkbox"/>
MCB Trip	80 A	<input type="checkbox"/>	<input checked="" type="checkbox"/>
MCB Frame	100 A	<input type="checkbox"/>	<input type="checkbox"/>
Cable Size	3CX25+1CX16(E)	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>

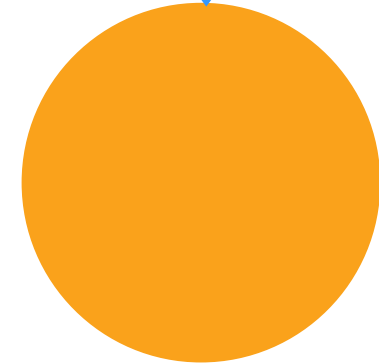


### 3 - Build your activity flow diagrams

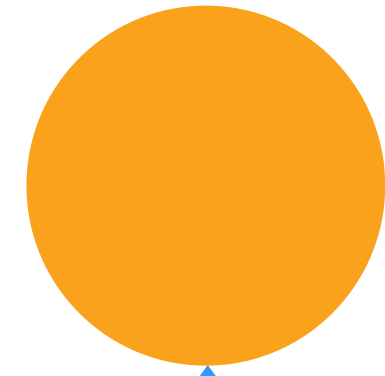
Analysis initiation



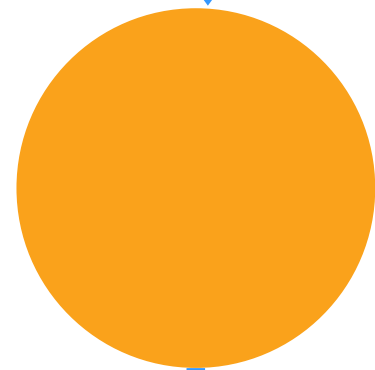
Extract model data



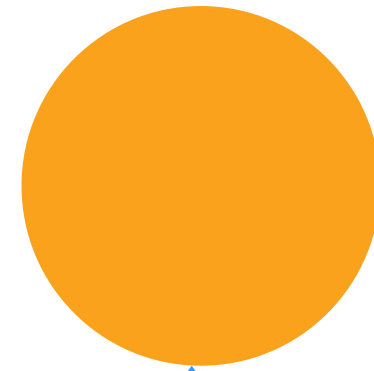
Highlight errors



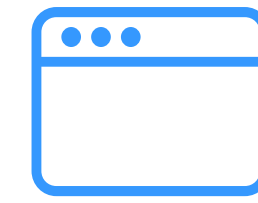
Apply technical quality check



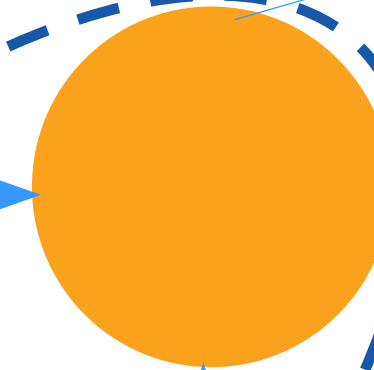
Invalid



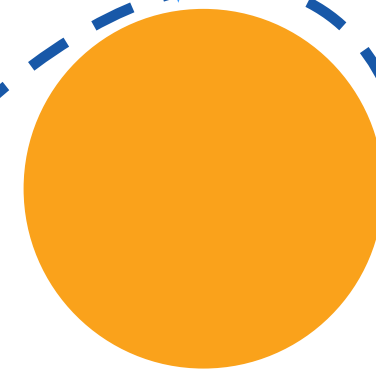
Valid



Calculation (Formulas)



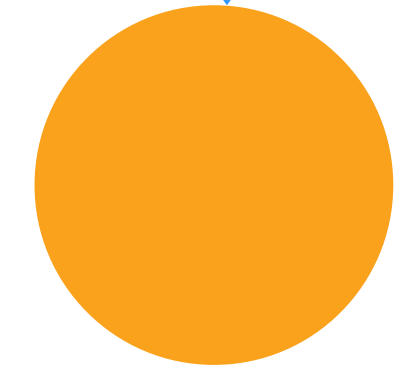
Settings



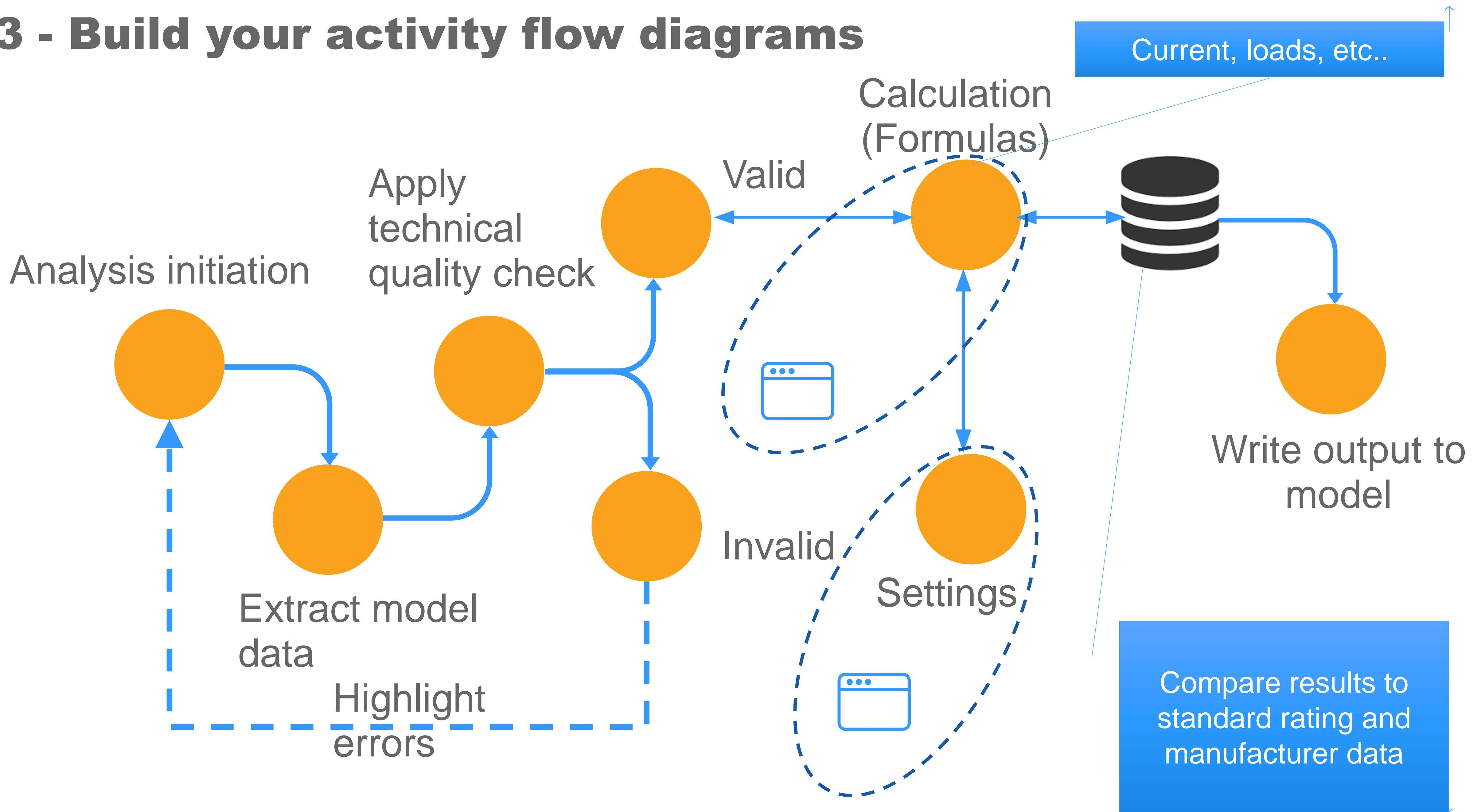
Current, loads, etc..



Write output to model



Compare results to standard rating and manufacturer data



# 04 – Build your database

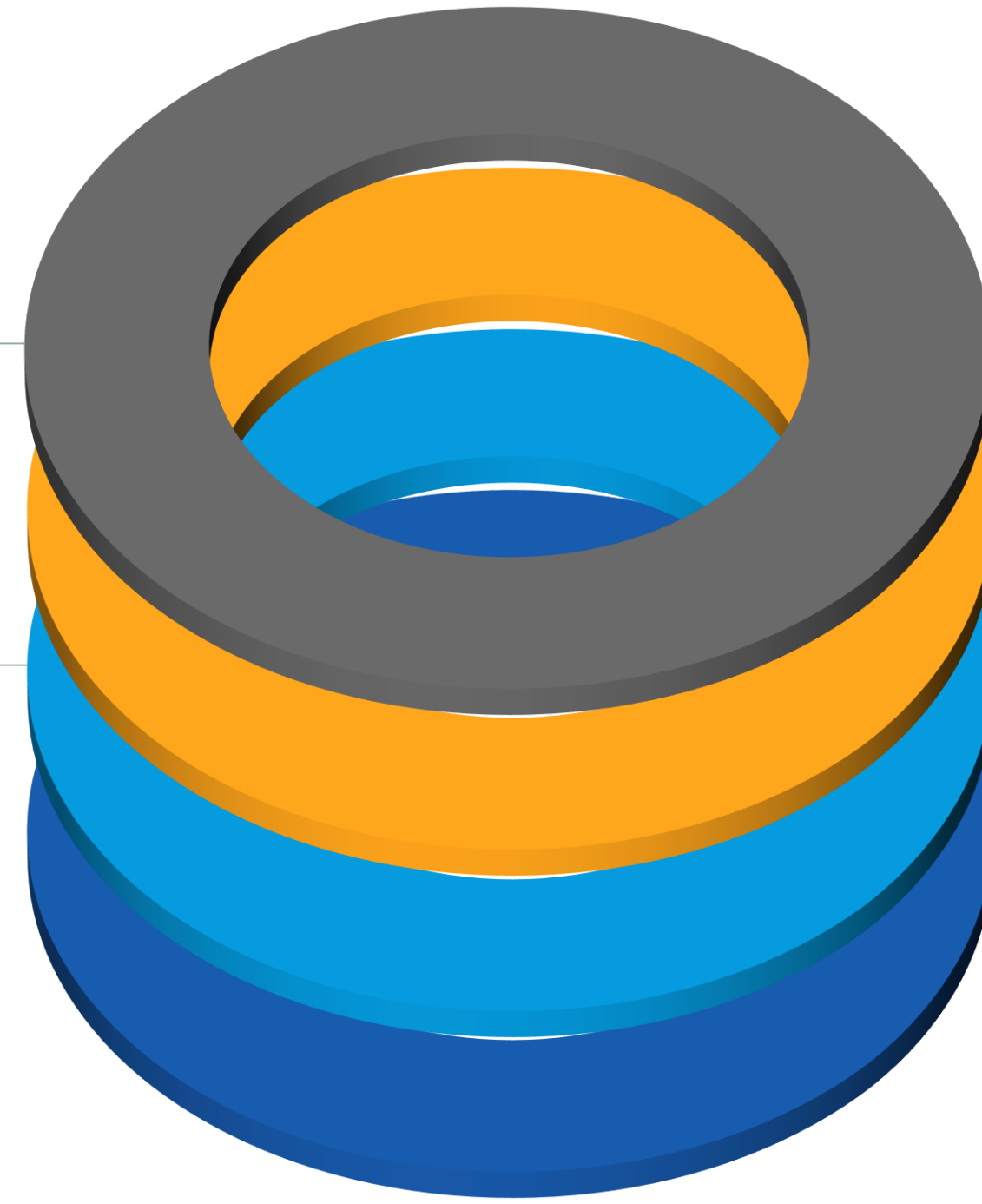
## 4- Tabulate database

- Microsoft Access
- Sql server
- Private cloud
- Online cloud



## 2 – Summarize data fields

- Ampere Trip
- Cable size
- Cable type



## 3 – Define technical datasets sources

- Code
- Regulation
- Manufacturer Data



## 1 – Summarize data categories

- Standard ratings
- Cable data
- Equipment data



# 5 – Interface design (Technical POV)

What are the default values?

The image shows a settings dialog box with a blue background. On the left is a sidebar with four menu items: 'Project settings', 'Protective devices settings', 'Standard breaker ratings', and 'General'. The 'Project settings' menu item is highlighted. The main area contains a table of settings:

Utility Fault	500 MVA
Ambient Temp	30° C
Overall demand factor	0.8
Frequency	50







At the bottom of the dialog are two buttons: 'Apply' and 'Cancel'. Annotations include a black arrow pointing from the text 'What are the default values?' to the 'Ambient Temp' field, and another black arrow pointing from the text 'What are the maximum and minimum values?' to the 'Ambient Temp' field. Two orange arrows are also present: one pointing up from the text '60° C' and another pointing down from the text '10° C'.

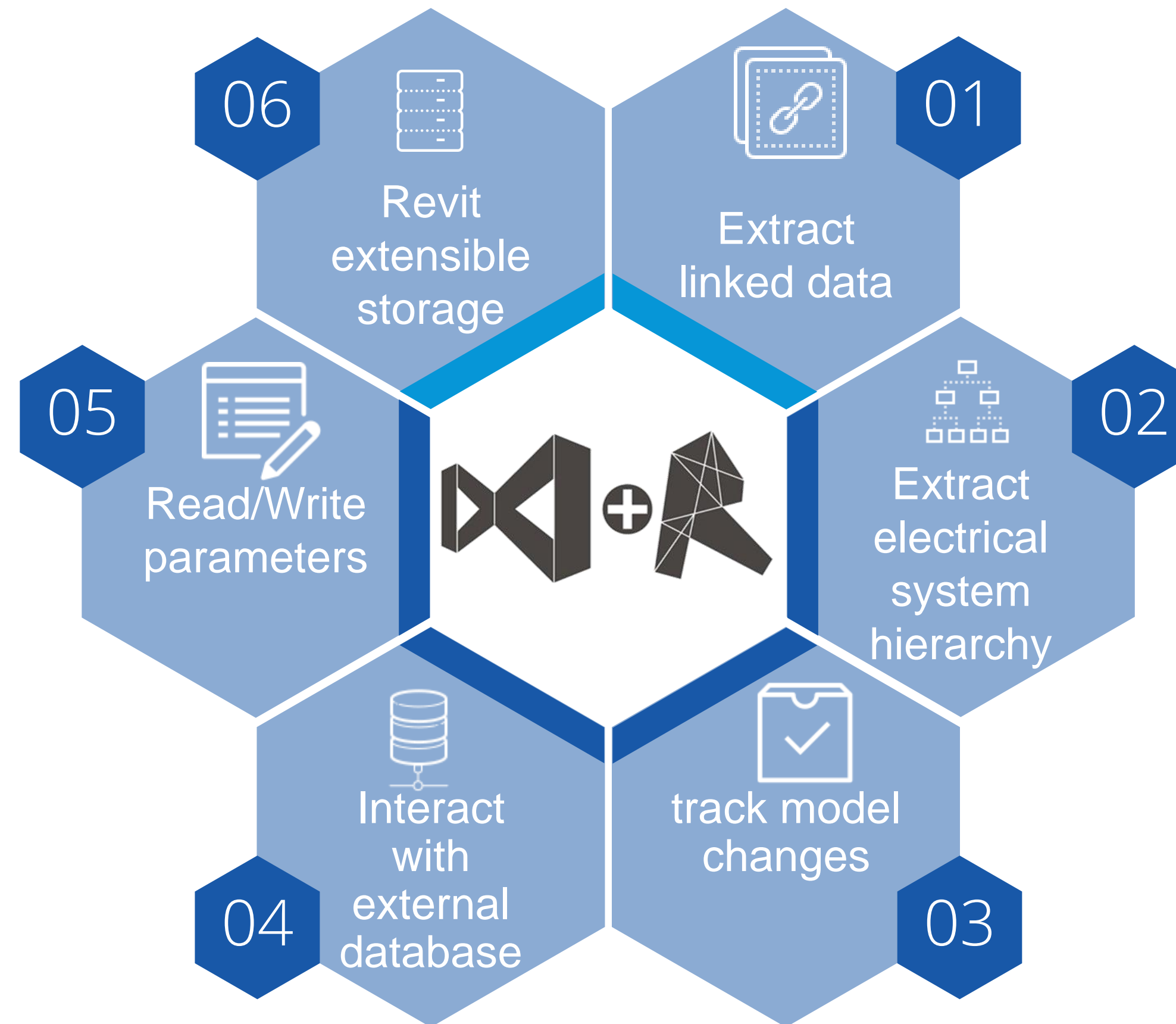
60° C

What are the maximum and minimum values?

10° C

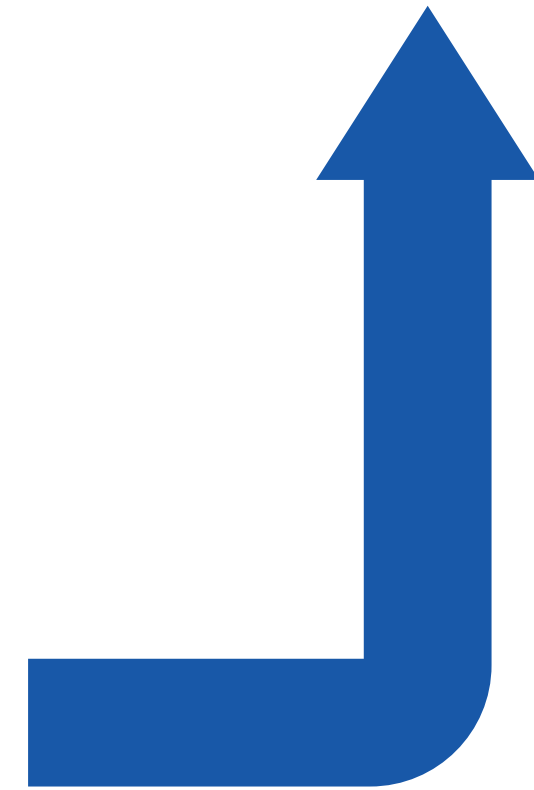
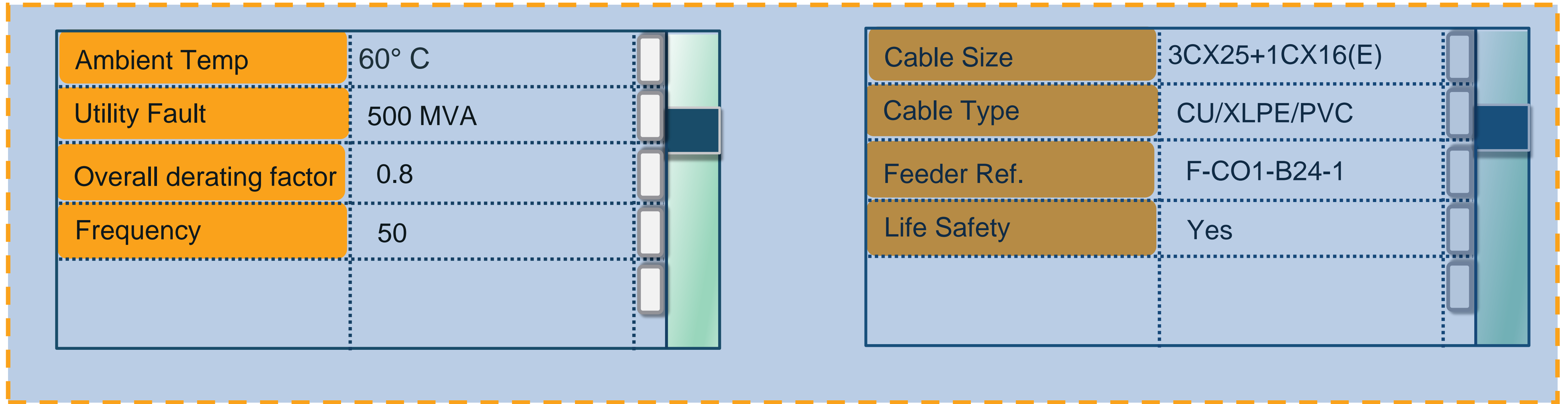
# What Revit API can do ?

- 01  Other trades data input
- 02  Accumulative or dependent analysis
- 03  Track input errors
- 04  Feeders & protection ratings
- 05  Record output on model
- 06  Special API feature

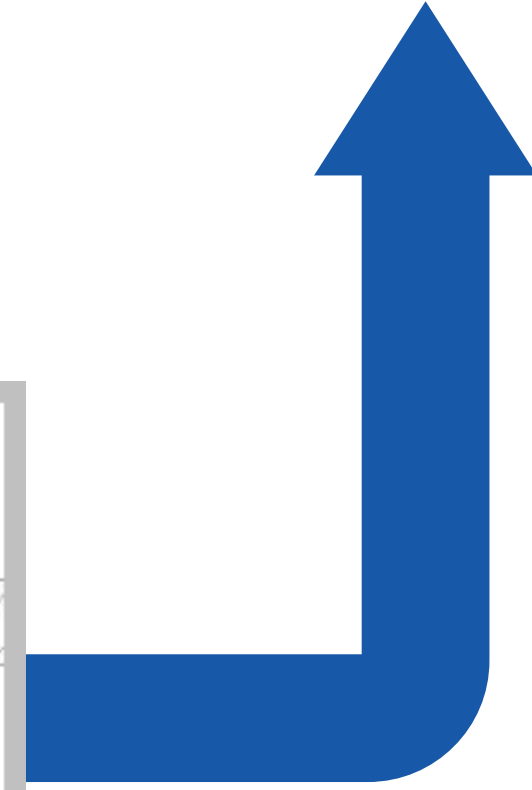
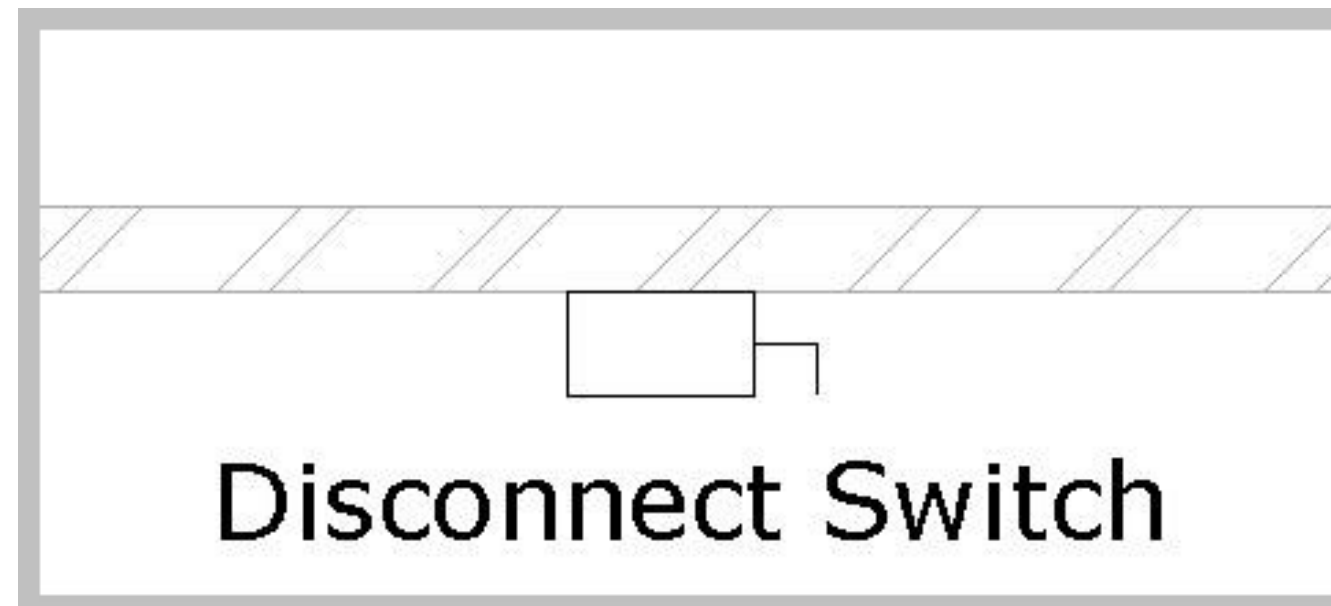




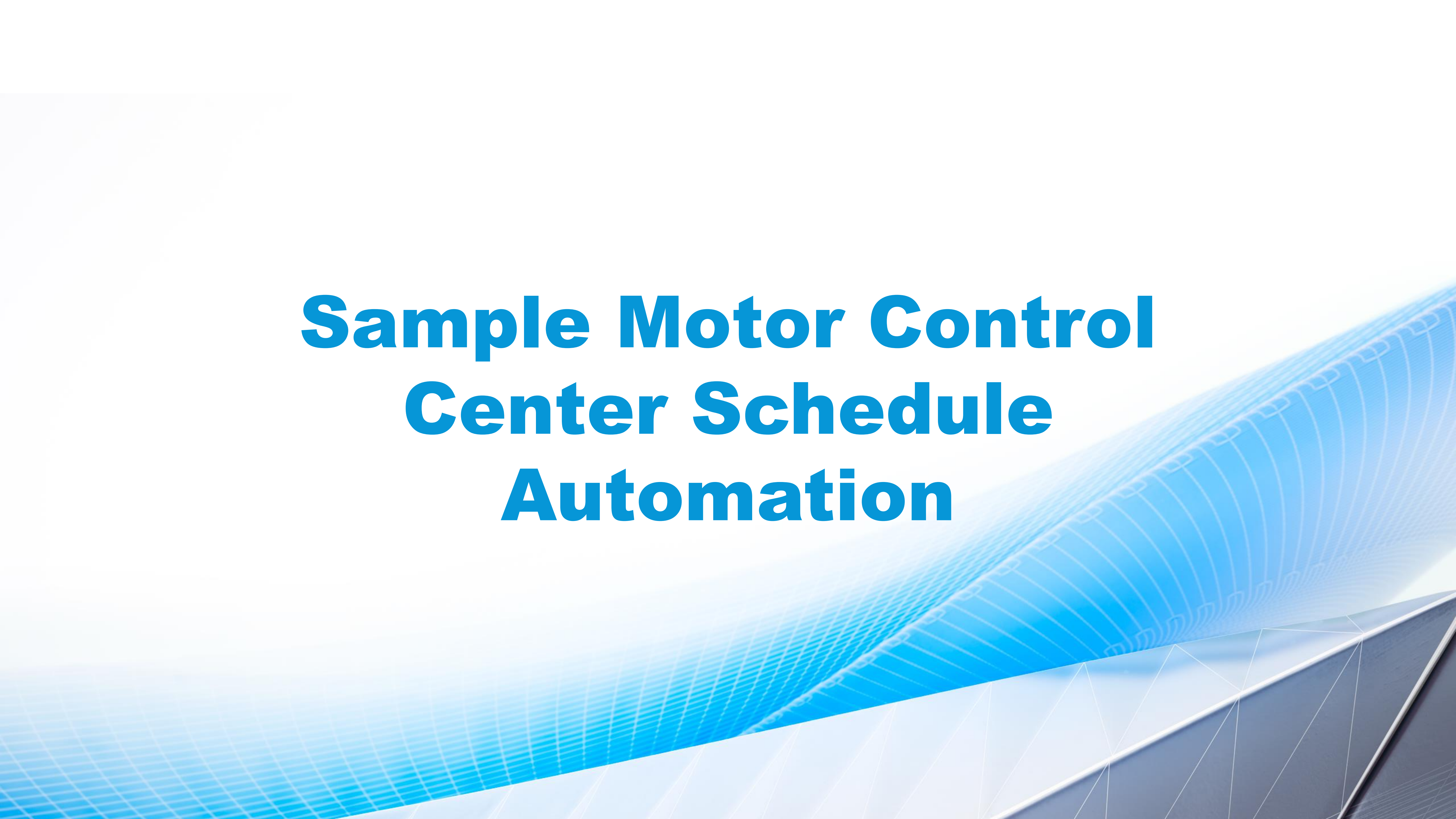
# Revit API Extensible Storage



User preferences stored in extensible storage invisible from user

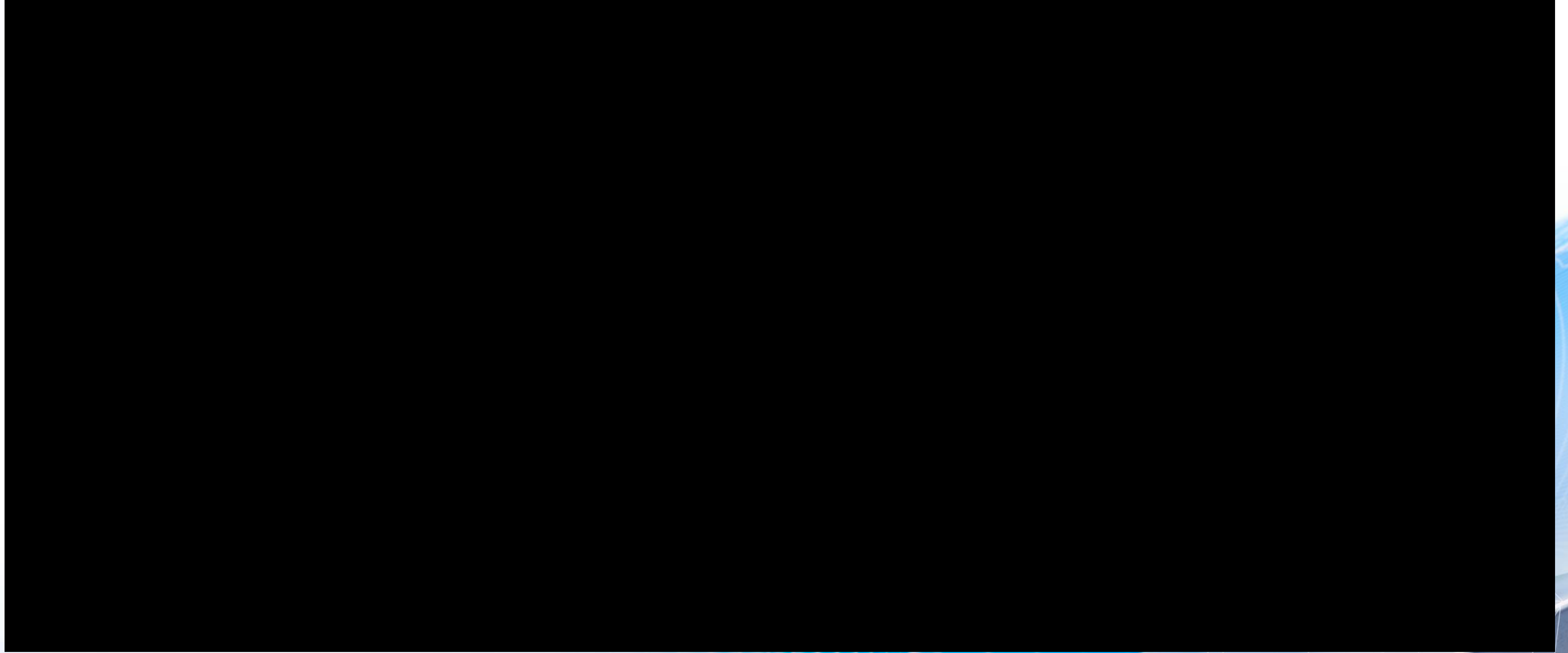


Hidden properties can be assigned to family instances



# **Sample Motor Control Center Schedule Automation**







# Questions







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