Construction Quality Control – Lessons Learned

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Agenda

- Introduction
- Lessons Learned -- Top Five Categories
  - Owner Technical Requirements
  - Interconnect Utility Technical Requirements
  - Phasing
  - SCADA/Communications/Telephony
  - “Interfaces”

Owner Technical Requirements

- Investigate and Clarify
  - Don’t assume “it was like your last project”
  - Read all the EPC contract technical specification references
- Rigorous Design Review – Identify areas of confusion, lack of clarity and discuss with Owner

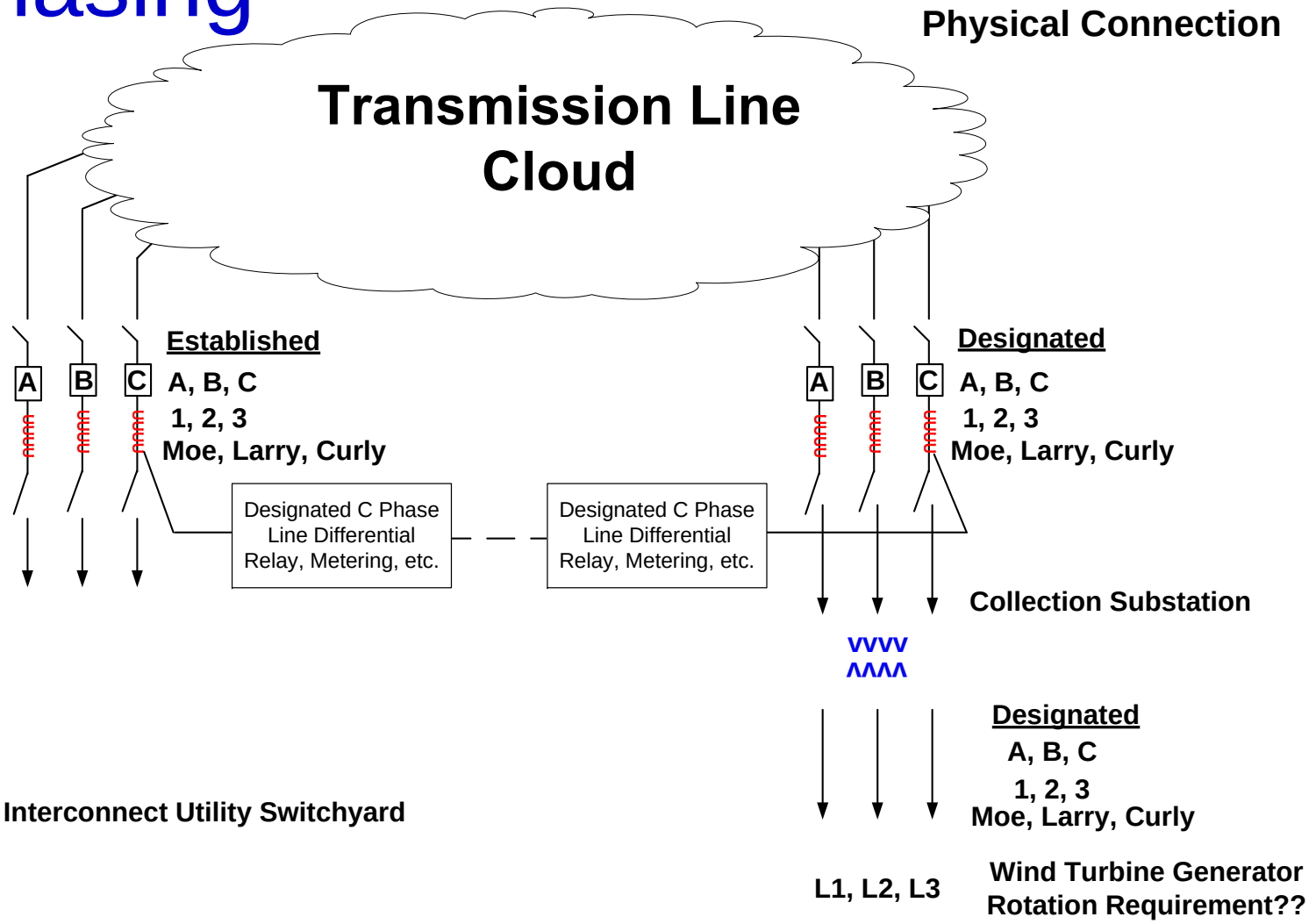
Interconnect Utility Technical Requirements

- Make and Develop Key Technical Contacts Early
- Identify Utility's Engineering, Construction and Testing Requirements, Witness Points
  - Relay Settings Development
  - Testing Requirements for connected Transmission Line or Substation Equipment

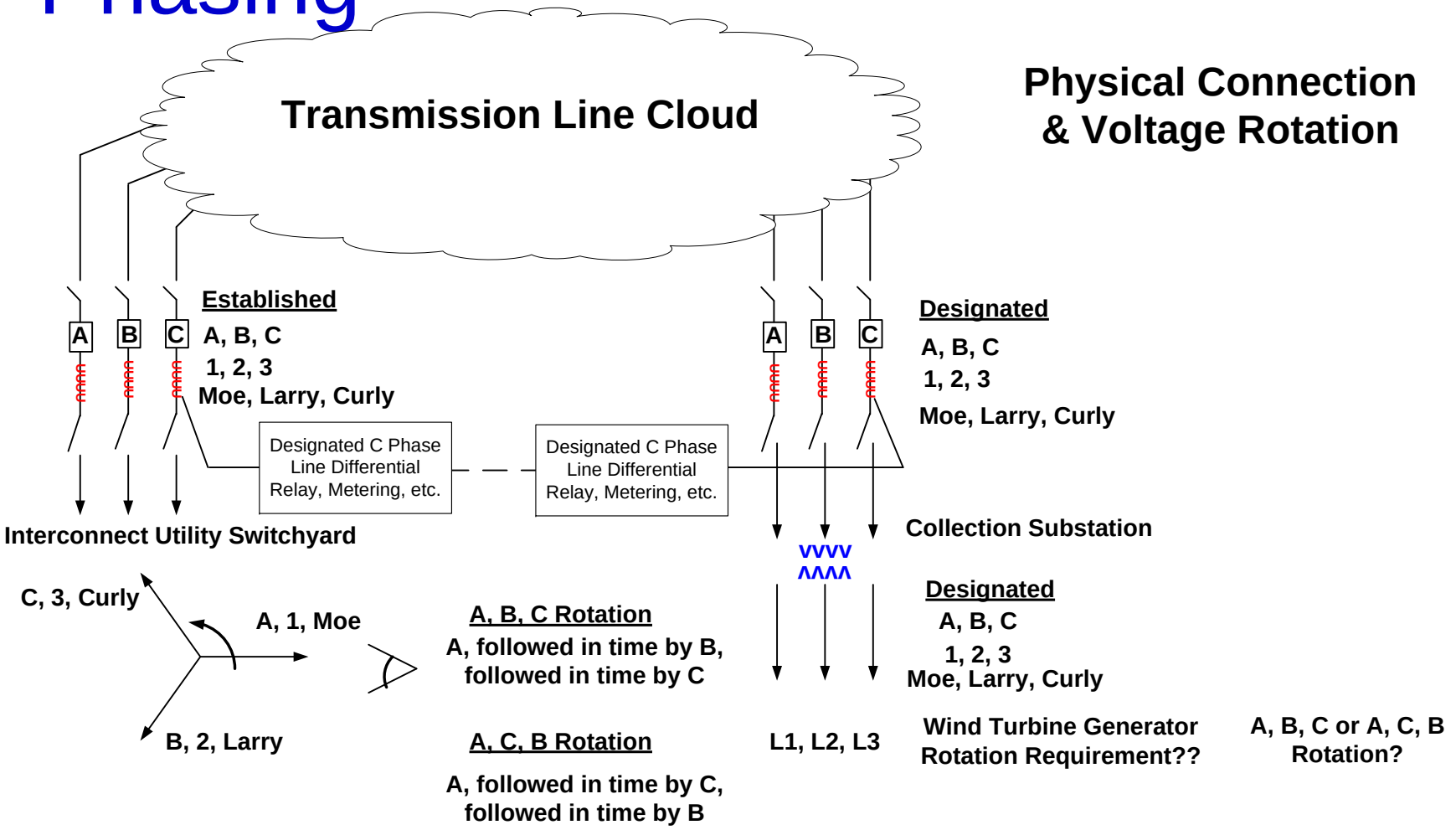
Phasing

- Physical
- Rotation

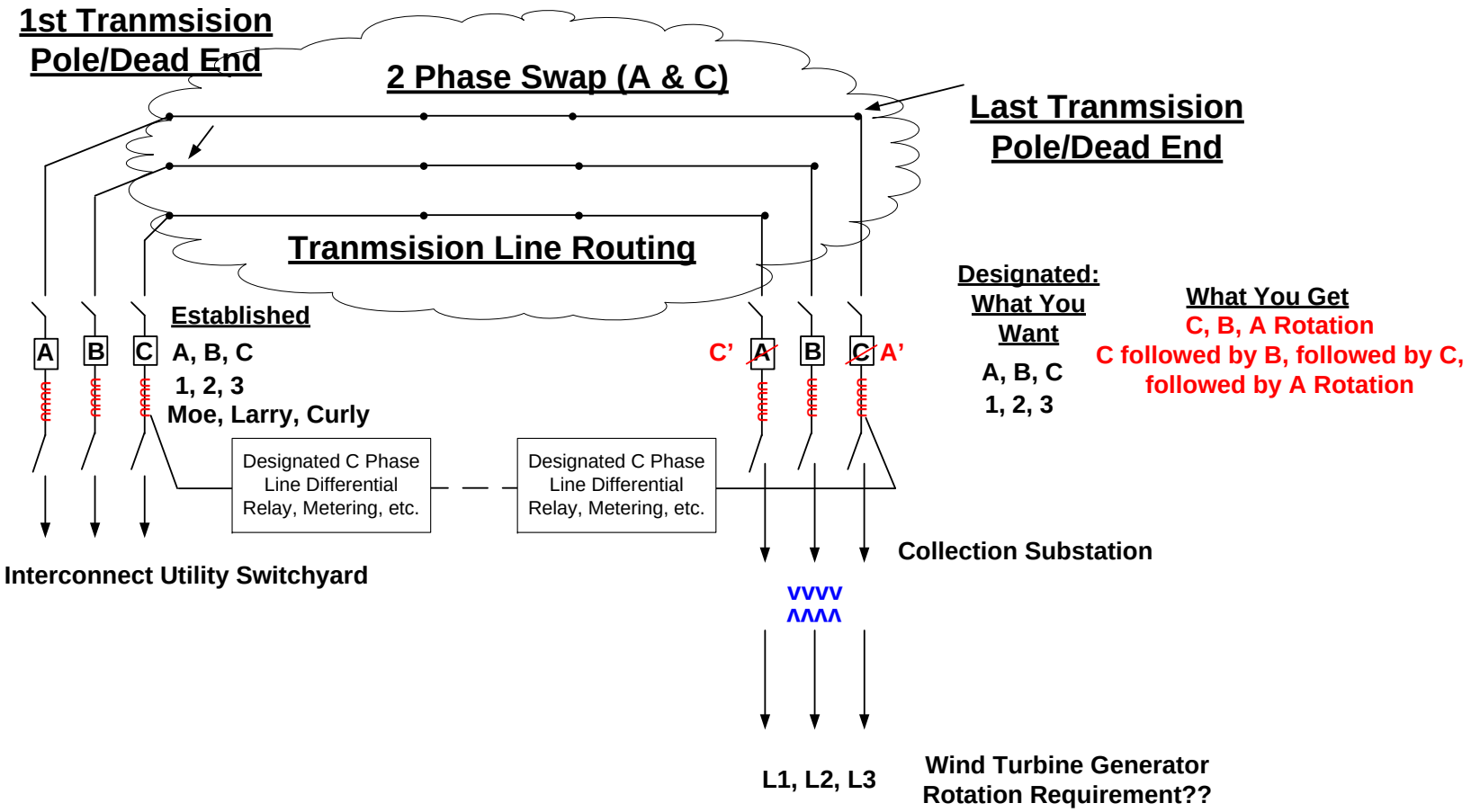
Phasing


Physical Connection
Transmission Line Cloud
Established
A, B, C
1, 2, 3
Moe, Larry, Curly
A
B
C
Designated C Phase Line Differential Relay, Metering, etc.
Designated C Phase Line Differential Relay, Metering, etc.
Designated
A, B, C
1, 2, 3
Moe, Larry, Curly
Collection Substation
Designated
A, B, C
1, 2, 3
Moe, Larry, Curly
Interconnect Utility Switchyard
L1, L2, L3
Wind Turbine Generator Rotation Requirement??

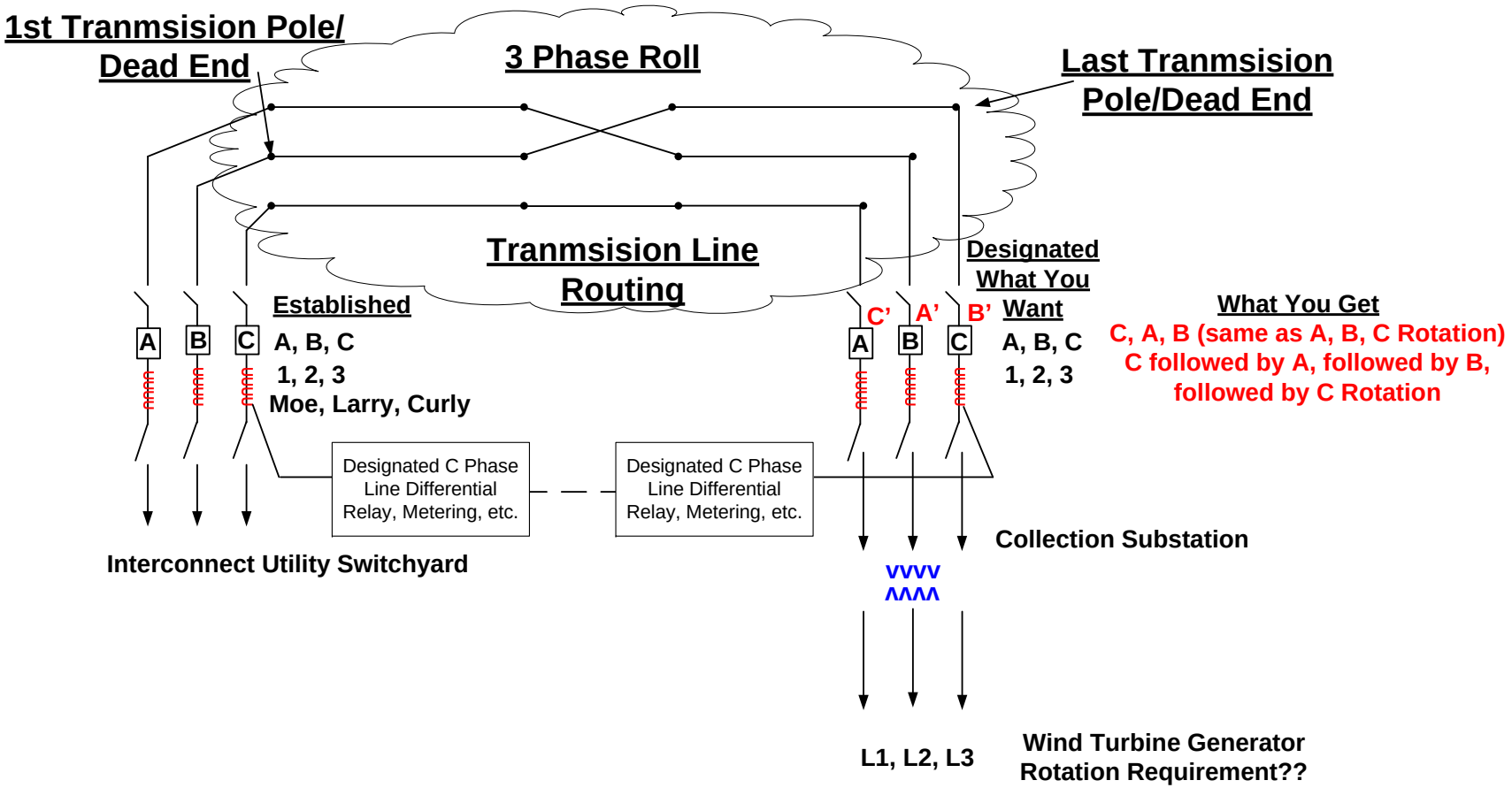
Phasing


Transmission Line Cloud
Physical Connection & Voltage Rotation
Established
A, B, C
1, 2, 3
Moe, Larry, Curly
A
B
C
Designated C Phase Line Differential Relay, Metering, etc.
Designated C Phase Line Differential Relay, Metering, etc.
Designated
A, B, C
1, 2, 3
Moe, Larry, Curly
Interconnect Utility Switchyard
Collection Substation
C, 3, Curly
A, 1, Moe
B, 2, Larry
A, B, C Rotation
A, followed in time by B, followed in time by C
A, C, B Rotation
A, followed in time by C, followed in time by B
L1, L2, L3
Designated
A, B, C
1, 2, 3
Moe, Larry, Curly
Wind Turbine Generator Rotation Requirement??
A, B, C or A, C, B Rotation?

Phasing


1st Tranmsision
Pole/Dead End
2 Phase Swap (A & C)
Last Tranmsision
Pole/Dead End
Tranmsision Line Routing
Established
A, B, C
1, 2, 3
Moe, Larry, Curly
A
B
C
C'
A
B
C
A'
Designated C Phase
Line Differential
Relay, Metering, etc.
Designated C Phase
Line Differential
Relay, Metering, etc.
Interconnect Utility Switchyard
Collection Substation
L1, L2, L3
Designated:
What You
Want
A, B, C
1, 2, 3
What You Get
C, B, A Rotation
C followed by B, followed by C,
followed by A Rotation
Wind Turbine Generator
Rotation Requirement??

Phasing


1st Tranmsision Pole/
Dead End
3 Phase Roll
Last Tranmsision
Pole/Dead End
Tranmsision Line
Routing
Established
A, B, C
1, 2, 3
Moe, Larry, Curly
A
B
C
Designated
What You
Want
C'
A'
B'
A, B, C
1, 2, 3
What You Get
C, A, B (same as A, B, C Rotation)
C followed by A, followed by B,
followed by C Rotation
Designated C Phase
Line Differential
Relay, Metering, etc.
Designated C Phase
Line Differential
Relay, Metering, etc.
Interconnect Utility Switchyard
Collection Substation
L1, L2, L3
Wind Turbine Generator
Rotation Requirement??

Phasing – Activities to Prevent Problems

- Engineering Interconnect Switchyard Walkdown
- Engineering Phasing Interface Sign-Off between Various Companies, Departments
- Construction Review of Substation and Transmission Line Drawings
- Construction Walkdown of Installed Transmission Line, Interconnect Switchyard Connection and Collection Substation

SCADA/Communications/Telephony

- Make and Develop Key Technical (SCADA, Communications, Telephone) Contacts Early
- Develop Detailed Roles/Responsibility Matrix for tasks:
  - Points List Development
  - Downloading / Programming
  - Testing

SCADA/Communications/Telephony

- Identify:
  - Protocols
  - Communication Media (Copper, Fiber, etc.)
  - Hardware
  - “Points” Required by All SCADA Parties (Owner, Operator, Utility, ISO)
  - Communicate with “Telephone Company” on their responsibility/requirements

SCADA/Communications/Telephony

Activity to Prevent Problem:

- Create a One-Line SCADA/Communications/Telephony Drawing Detailing:
  - Hardware (at all ends) with designated ownership of design / installation
  - Connectivity between hardware

“Interfaces”

- Know and understand the “Interfaces”
- They are typically the areas of confusion / problems / gaps
- Detail tasks with subsequent responsibilities
- Work the “interfaces” even more diligently
  - Communicate clearly
  - Understand the “other end” so you can ask the challenging questions to make sure “your end” is correct

- Don’t let “Interfaces” become “Gaps”