



# A PRACTICAL FRAMEWORK FOR EFFECTIVE REQUIREMENTS MANAGEMENT THROUGHOUT THE LIFE-CYCLE

**NATIONAL DEFENSE INDUSTRIAL ASSOCIATION [NDIA]**

19TH ANNUAL SYSTEMS ENGINEERING CONFERENCE – TRACK 2 SYSTEMS ENGINEERING EFFECTIVENESS [SESSION 18916]  
SPRINGFIELD, VA – OCTOBER 26, 2016

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# AGENDA

- **Problem Statement**
  - Poor Project Performance
- **Offered Solution**
  - Improving Requirements Management Effectiveness using Communication Management Principles
- **Practical Example**
  - Safety & Security Stakeholder Requirements
- **Summary & Conclusions**

# PROBLEM STATEMENT

## POOR PROJECT PERFORMANCE



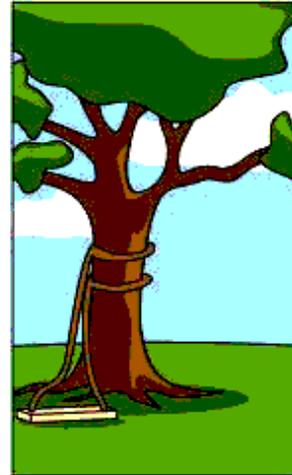
How the customer explained it



How the Project Leader understood it



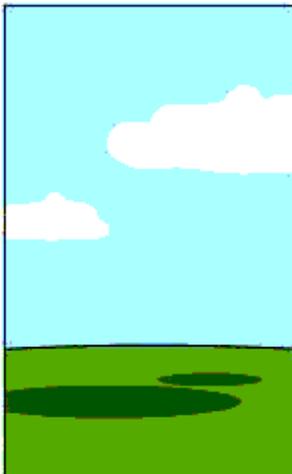
How the Analyst designed it



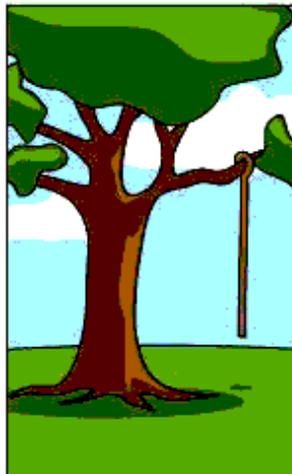
How the Programmer wrote it



How the Business Consultant described it



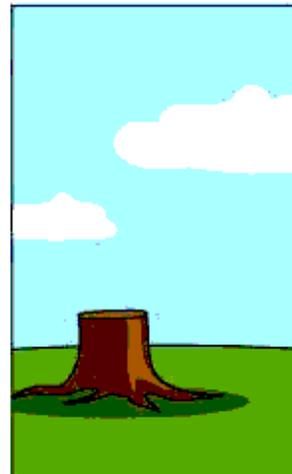
How the project was documented



What operations installed



How the customer was billed

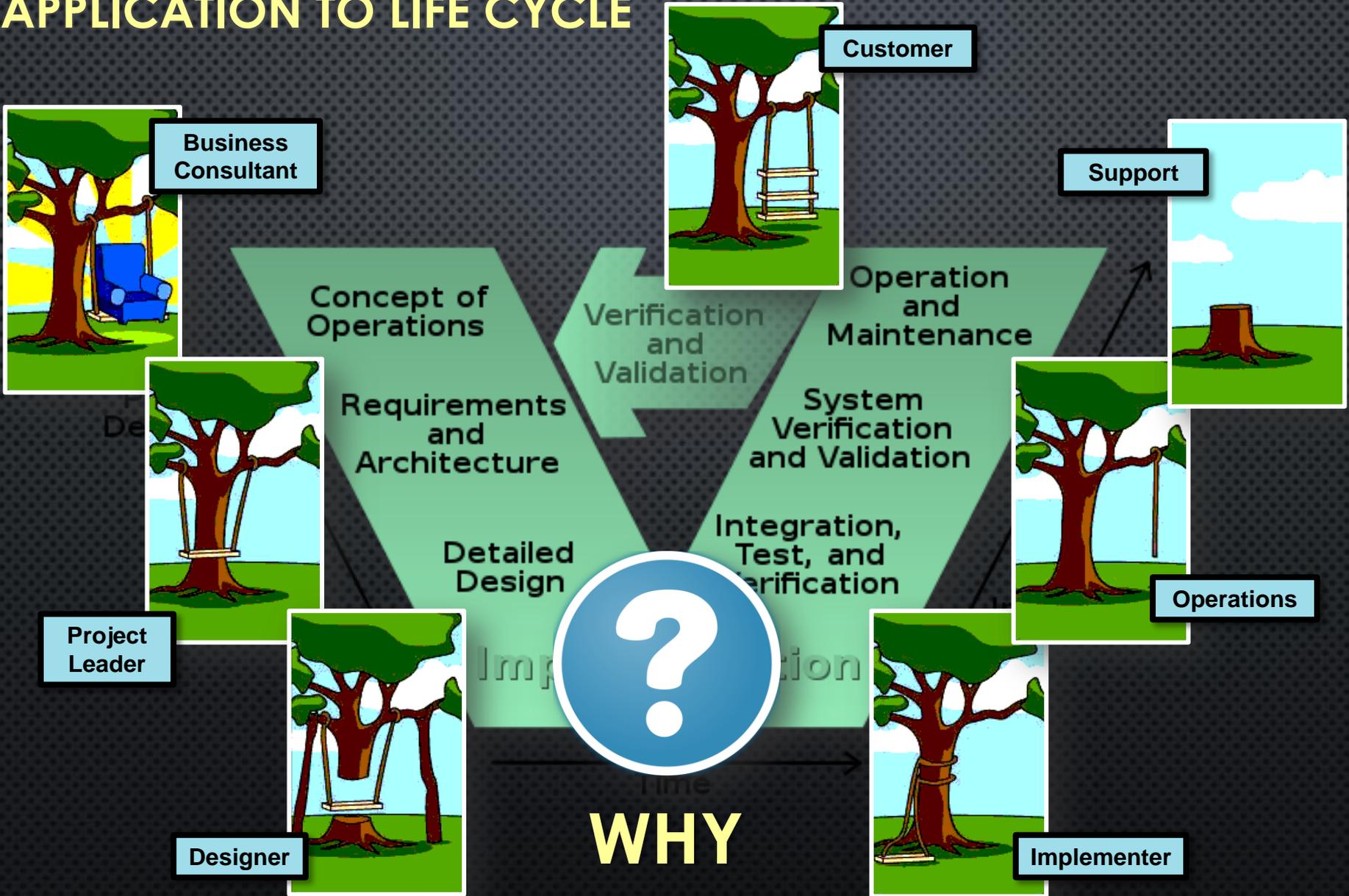


How it was supported



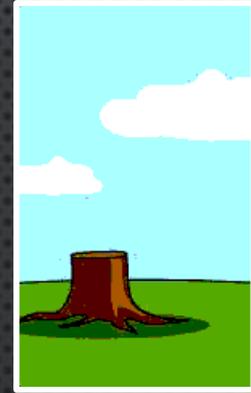
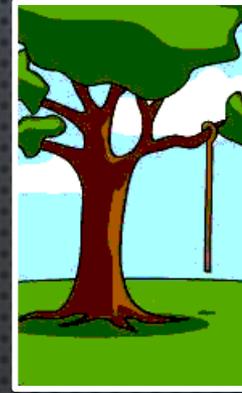
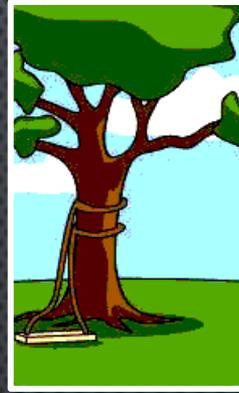
What the customer really needed

# PROBLEM STATEMENT APPLICATION TO LIFE CYCLE



# PROBLEM STATEMENT

## PROJECTS ARE DONE BY PEOPLE



Customer

Business  
Consultant

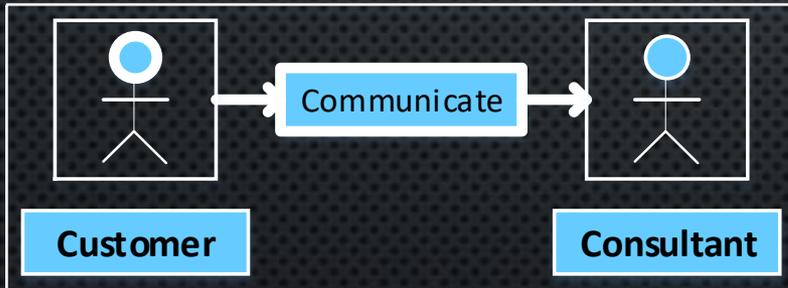
Project  
Leader

Designer

Implementer

Operations

Support



Work is performed by and between people communicating with each other throughout the life cycle phases

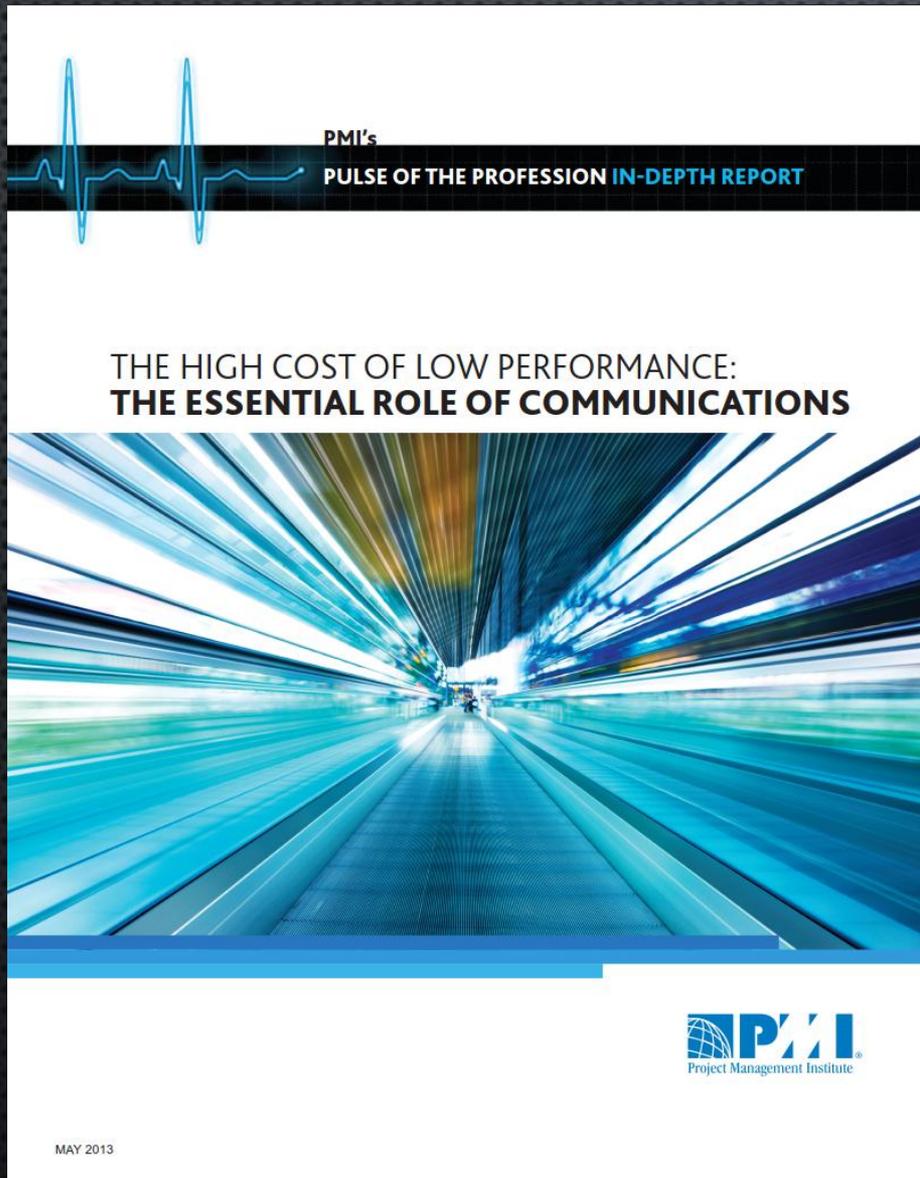
Business / Mission Requirements Analysis



Project Planning & Execution

# PROBLEM STATEMENT

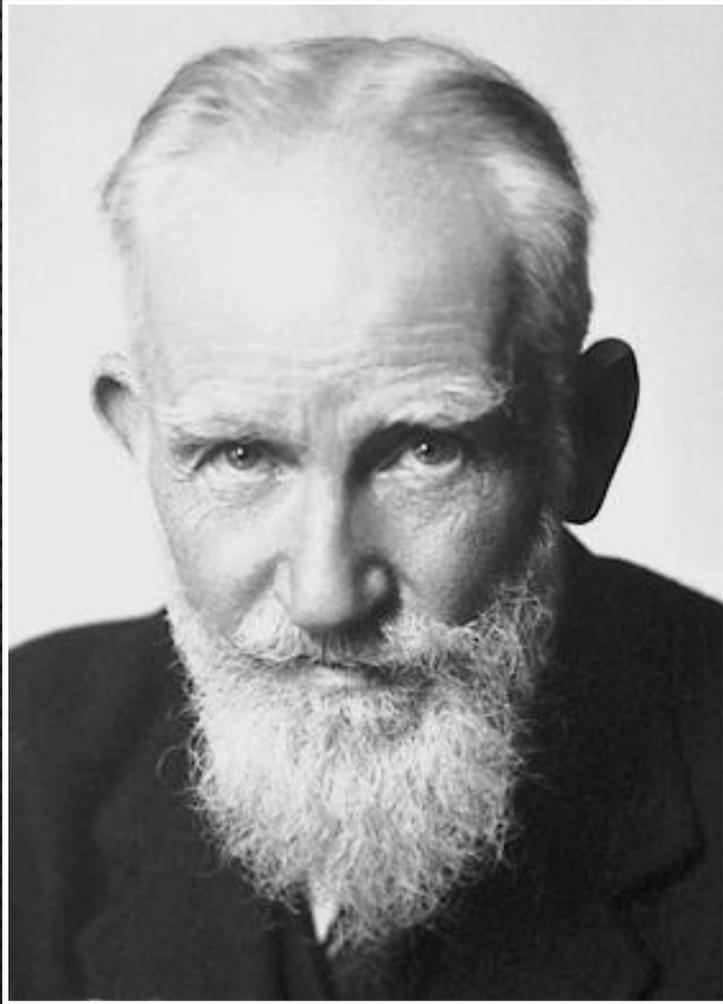
## IMPORTANCE OF EFFECTIVE COMMUNICATION



**“... the most crucial success factor in project management is effective communications to all stakeholders”**

# PROBLEM STATEMENT

## COMMUNICATION ILLUSION



**“The single biggest problem in communication is the illusion that it has taken place”**

**- George Bernard Shaw**

# PROGRESS

## ➤ **Problem Statement**

- Poor Project Performance

## ➤ **Offered Solution**

- Improving Requirements Management Effectiveness using Communication Management Principles

## ➤ **Practical Example**

- Safety & Security Stakeholder Requirements

## ➤ **Summary & Conclusions**

# OFFERED SOLUTION

## EFFECTIVE REQUIREMENTS MANAGEMENT

### Requirements management

Requirements management is the process of documenting, analyzing, tracing, prioritizing and agreeing on requirements and then controlling change and communicating to relevant stakeholders. It is a continuous process throughout a project. A requirement is a capability to which a project outcome (product or service) should conform.

**Requirements management** - Wikipedia, the free encyclopedia  
[https://en.wikipedia.org/wiki/Requirements\\_management](https://en.wikipedia.org/wiki/Requirements_management)

See more about Requirements management 

**Business / Mission  
Requirements**

**Stakeholder  
Requirements**

**System  
Requirements**

**System Element  
Requirements**

**Basis for Design &  
Implementation**

**Basis for Verification  
& Validation**

**Increase Requirements Management Effectiveness  
by using Communication Management Principles**

# OFFERED SOLUTION

## CRITICAL SUCCESS FACTORS FOR PROJECT MANAGERS

**1. Agree on the project goals.** Make sure there is agreement with management, project sponsors, and other stakeholders on the purpose and goals of the project. What problem will the project solve? What is the desired end result? What need will the project fill? Goals should be specific and measurable. Clear measurable goals will help define the project scope.

**Project Goals**

**2. Develop clearly defined plans with assigned responsibilities and accountabilities.** Developing a plan is just entering the tasks into a software application like Microsoft project. All the deliverables need to be defined with the necessary tasks to produce them and any associated risks. Responsibilities should be assigned to the tasks and deliverables with appropriate due dates and accountabilities. The planning process should also include risk management activities and communication requirements. Developing the project schedule is only a part of the planning process.

**Responsibilities & Accountabilities**

**3. Manage the project scope effectively.** The project scope is defined in the goal setting, and planning stage of the project. It would be nice if the scope never changed, but the real world says that scopes change. The project manager must always be on the alert for changes to the scope and effectively manage those changes. Are the changes really necessary for project success or just nice to haves? What affect will the changes have on the budget and the schedule? Has everyone agreed that the change must be done? How are the changes tracked? Managing the scope is one of the more challenging parts of managing projects.

**Project Scope**

**4. Cultivate constant effective communications.** Determine the communication channels needed to inform relevant stakeholders of the progress of the project. Management and project sponsors may want regular status reports or only the highlights and the exceptions. Suppliers, clients and/or customers may need statements of work, contracts, and progress reviews. The project team will need task assignments and regular briefings. The frequency and types of communication for each channel should be defined and managed. Incorporate this communication plan into the project plan and manage it because of poor communications.

**Effective Communication**

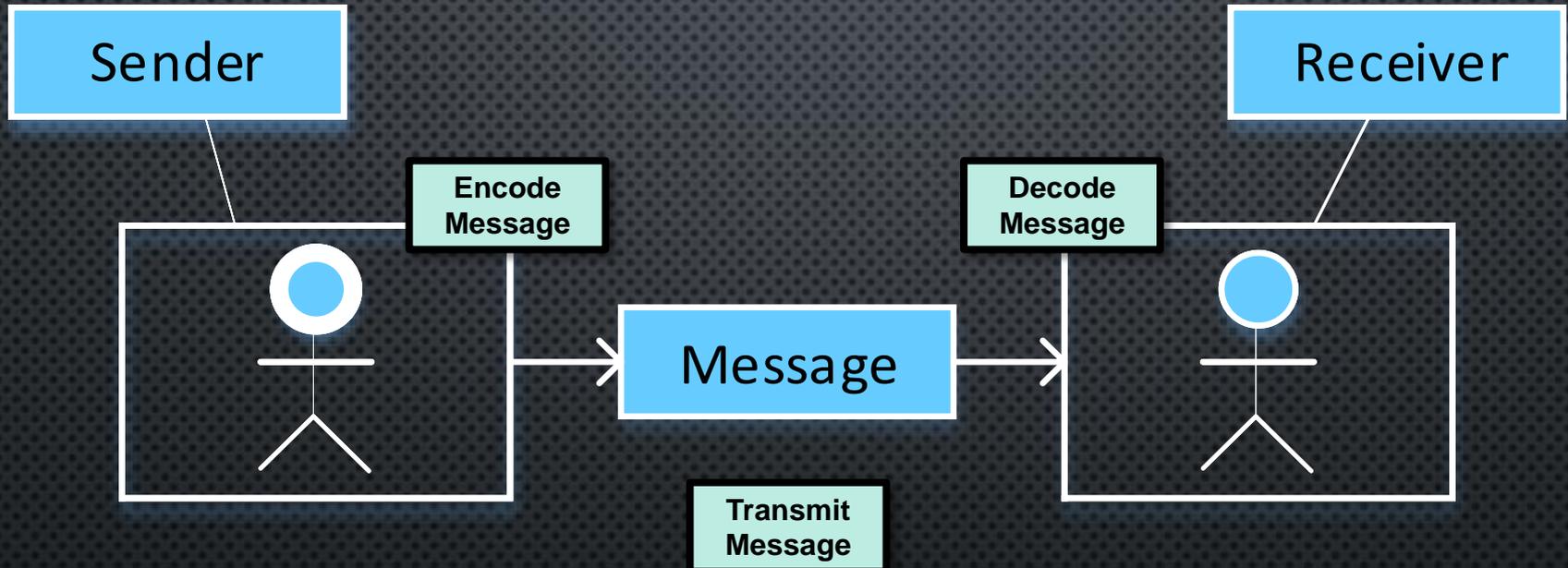
**Goals, Scope, and Allocations  
are all part of Requirements Management**

**North Carolina  
State University**

**5. Make sure everyone agrees that the project is important, will add value to the business, or solve a pressing problem.**

# OFFERED SOLUTION

## PRINCIPLES OF COMMUNICATION

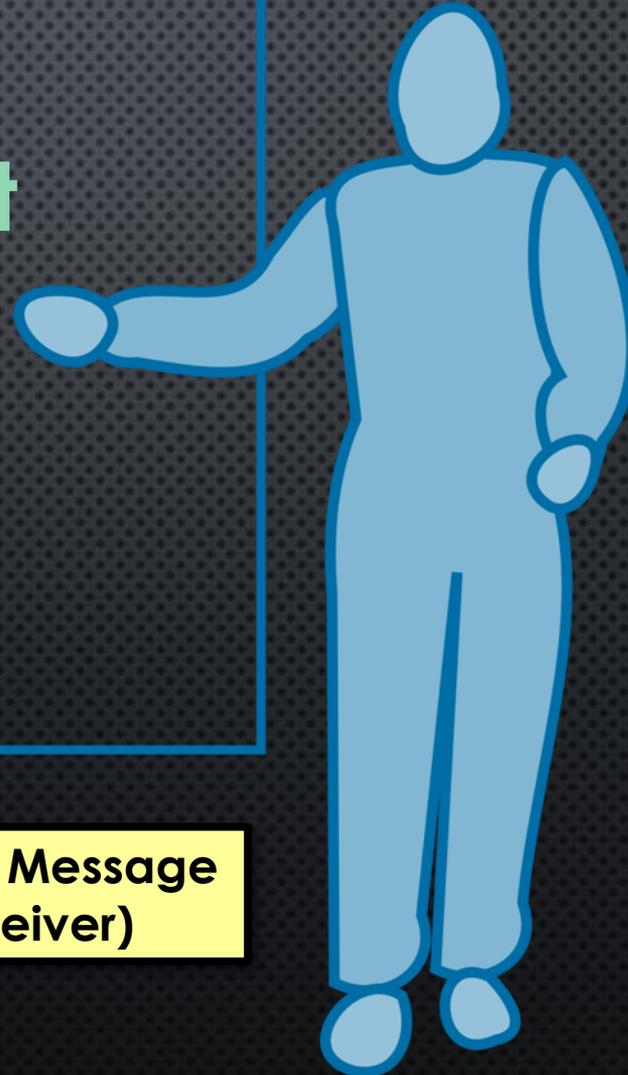


**Sender is responsible that the Receiver understands the Message**

**OFFERED SOLUTION**

**GOOD PRESENTATION (COMMUNICATION) SKILLS**

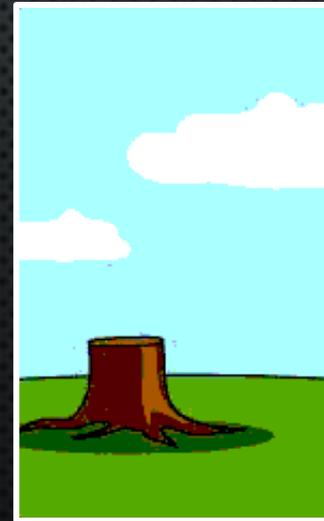
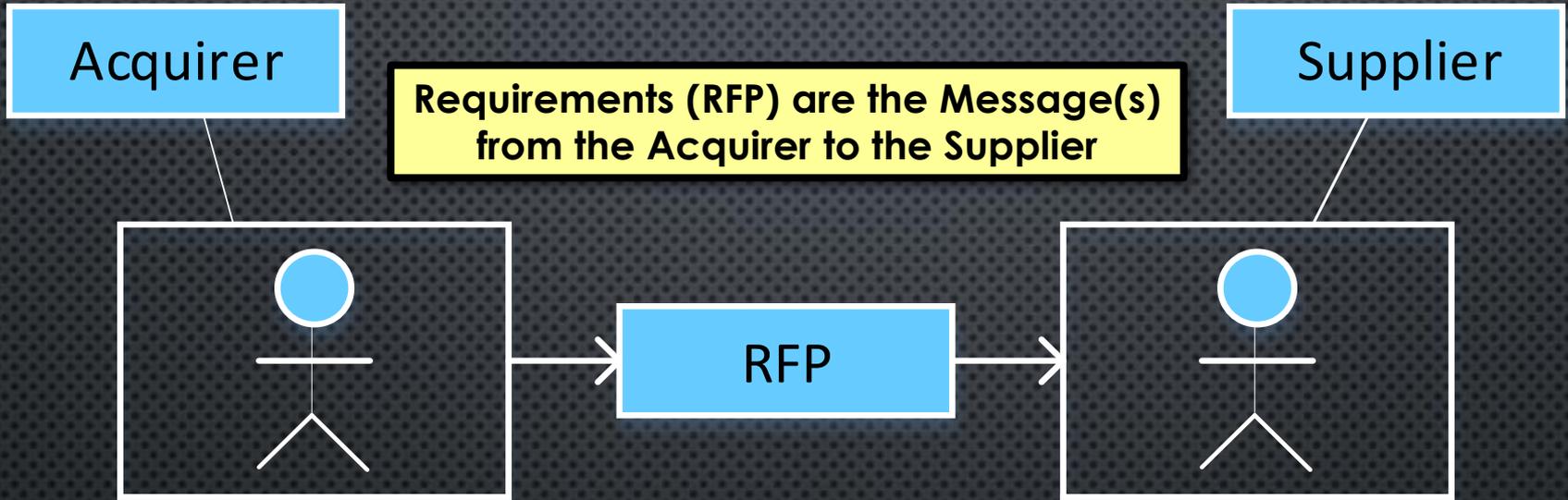
**It is all about  
YOUR  
Audience**



**As the Sender, tailor YOUR Message  
to Your Audience (Receiver)**

# OFFERED SOLUTION

## APPLICATION TO DoD ACQUISITIONS

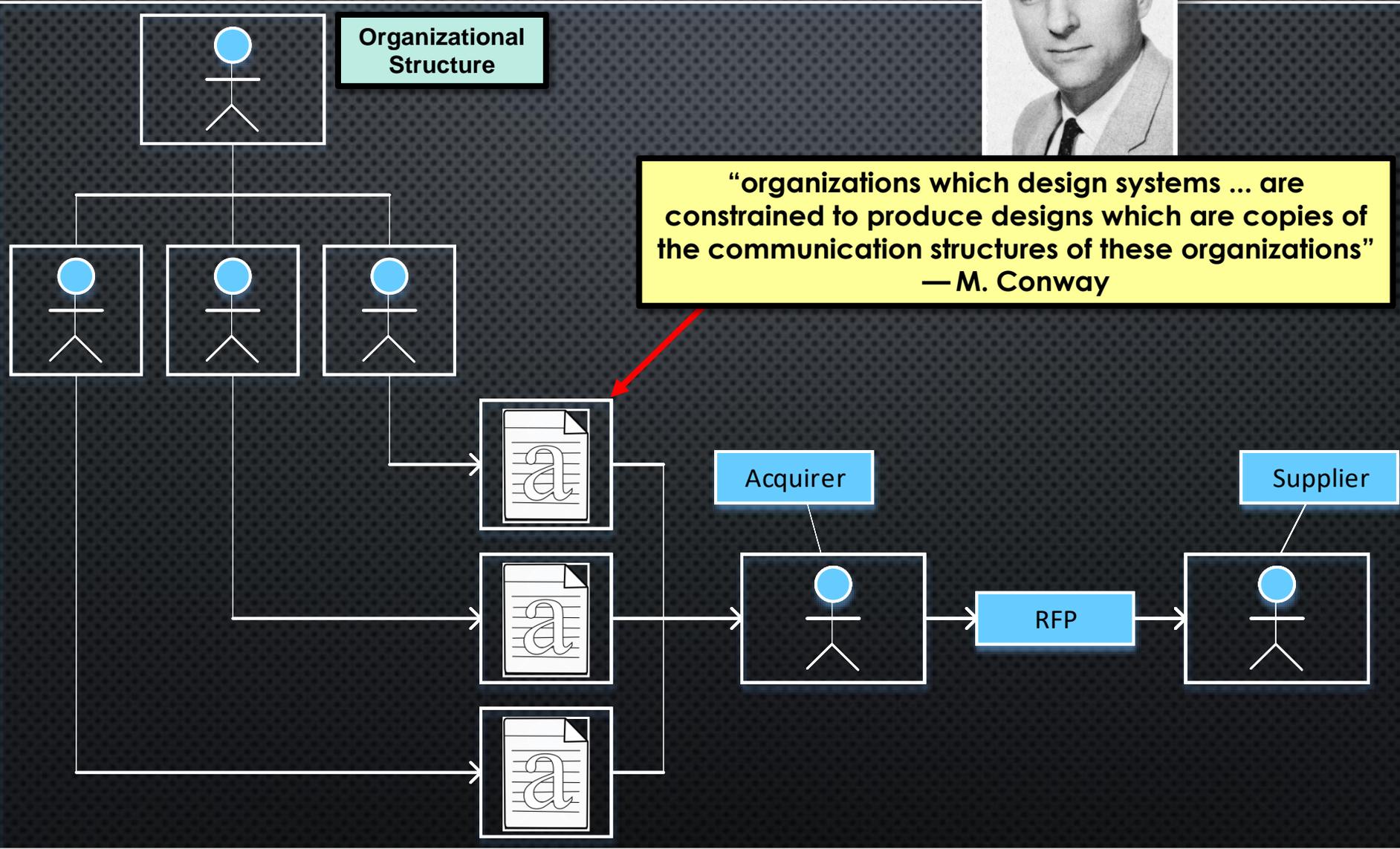


# OFFERED SOLUTION

## MULTIPLE ACQUIRERS



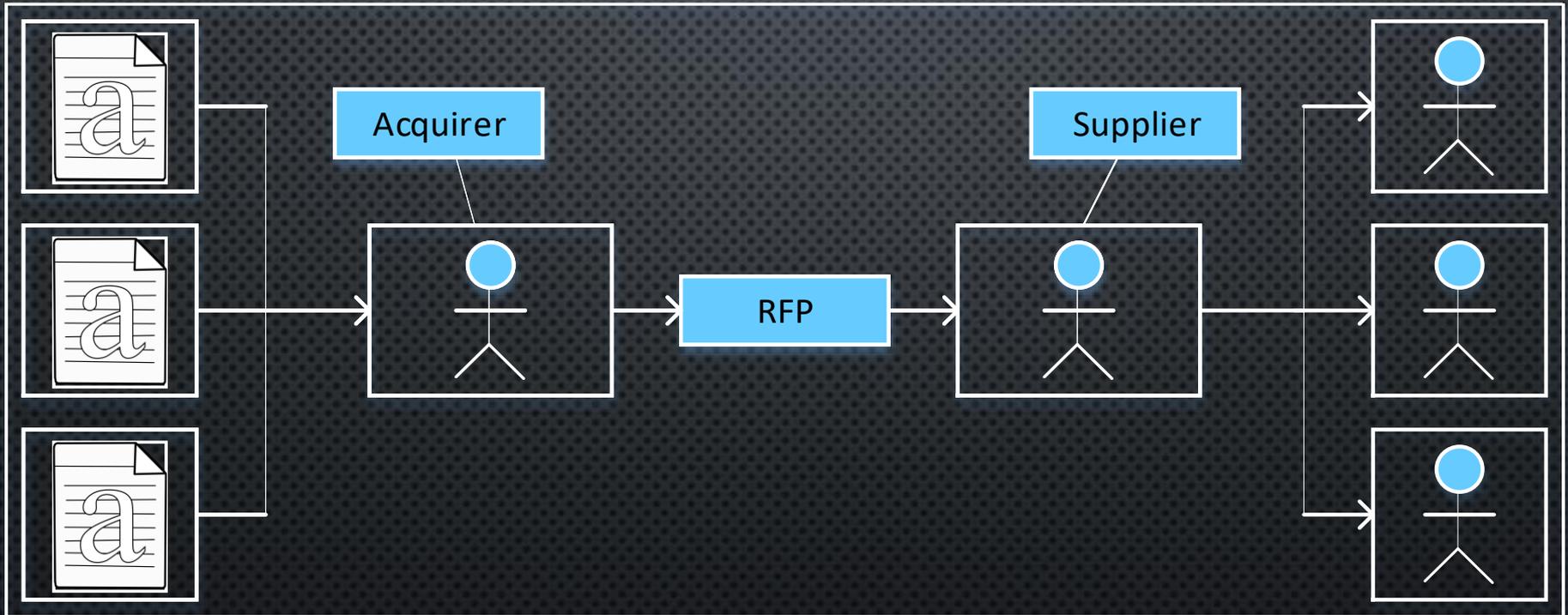
Organizational Structure



**“organizations which design systems ... are constrained to produce designs which are copies of the communication structures of these organizations”  
— M. Conway**

# OFFERED SOLUTION

## MULTIPLE RECEIVERS

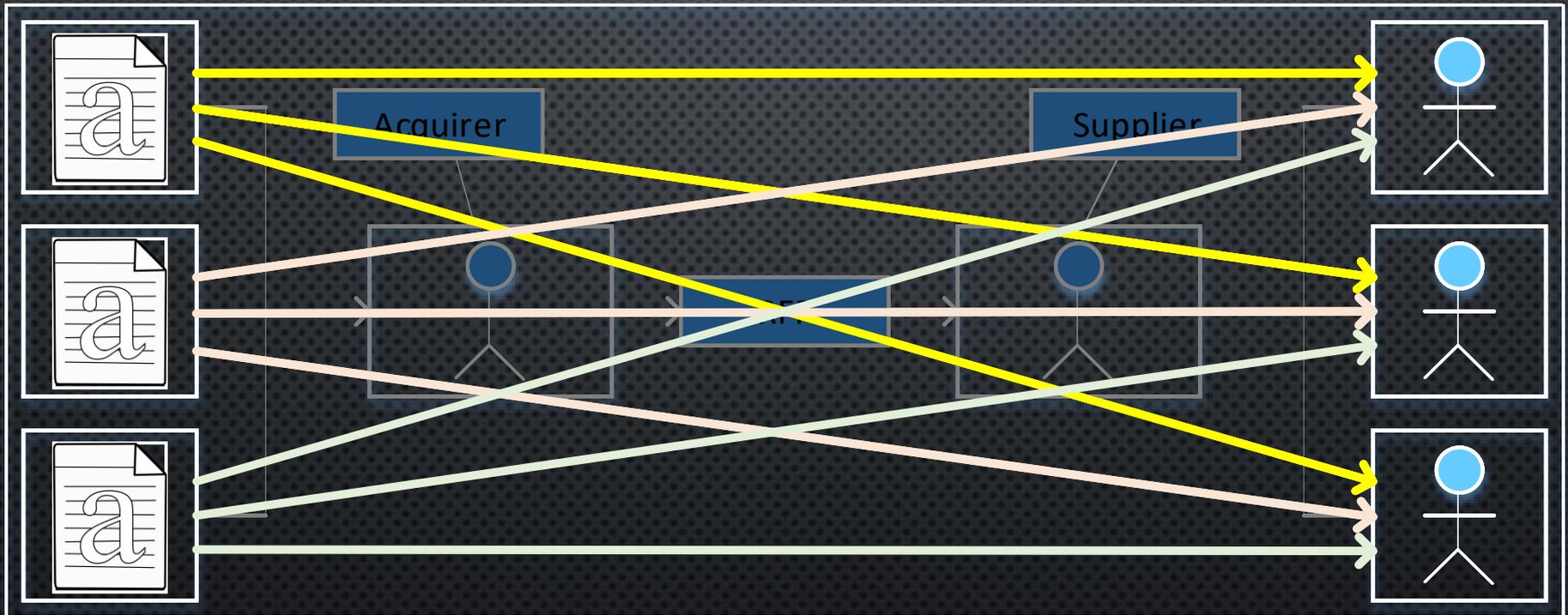


# OFFERED SOLUTION

## MULTIPLE ACQUIRER MESSAGES

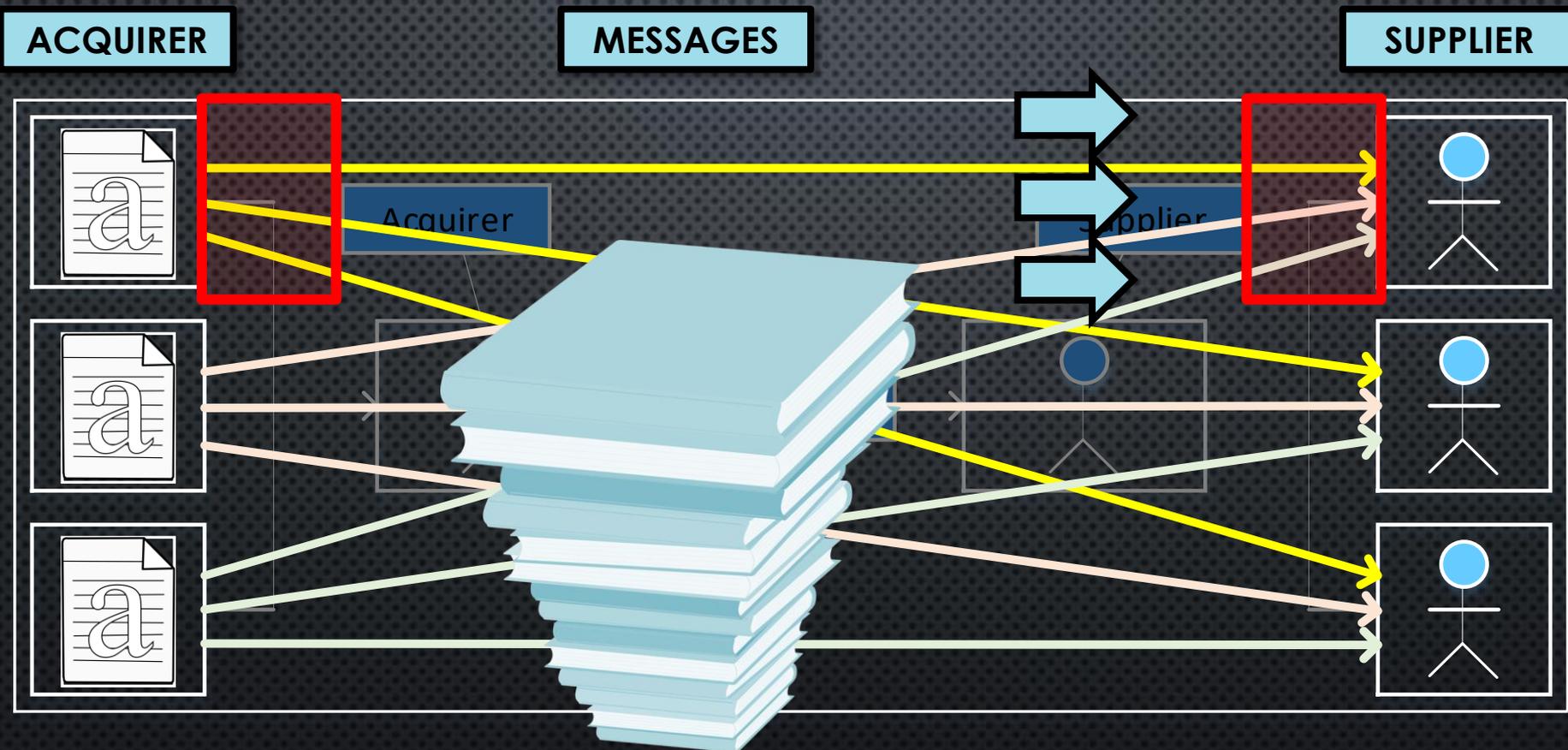
ACQUIRER

SUPPLIER



# OFFERED SOLUTION

## ENCODING VS. DECODING EFFORT

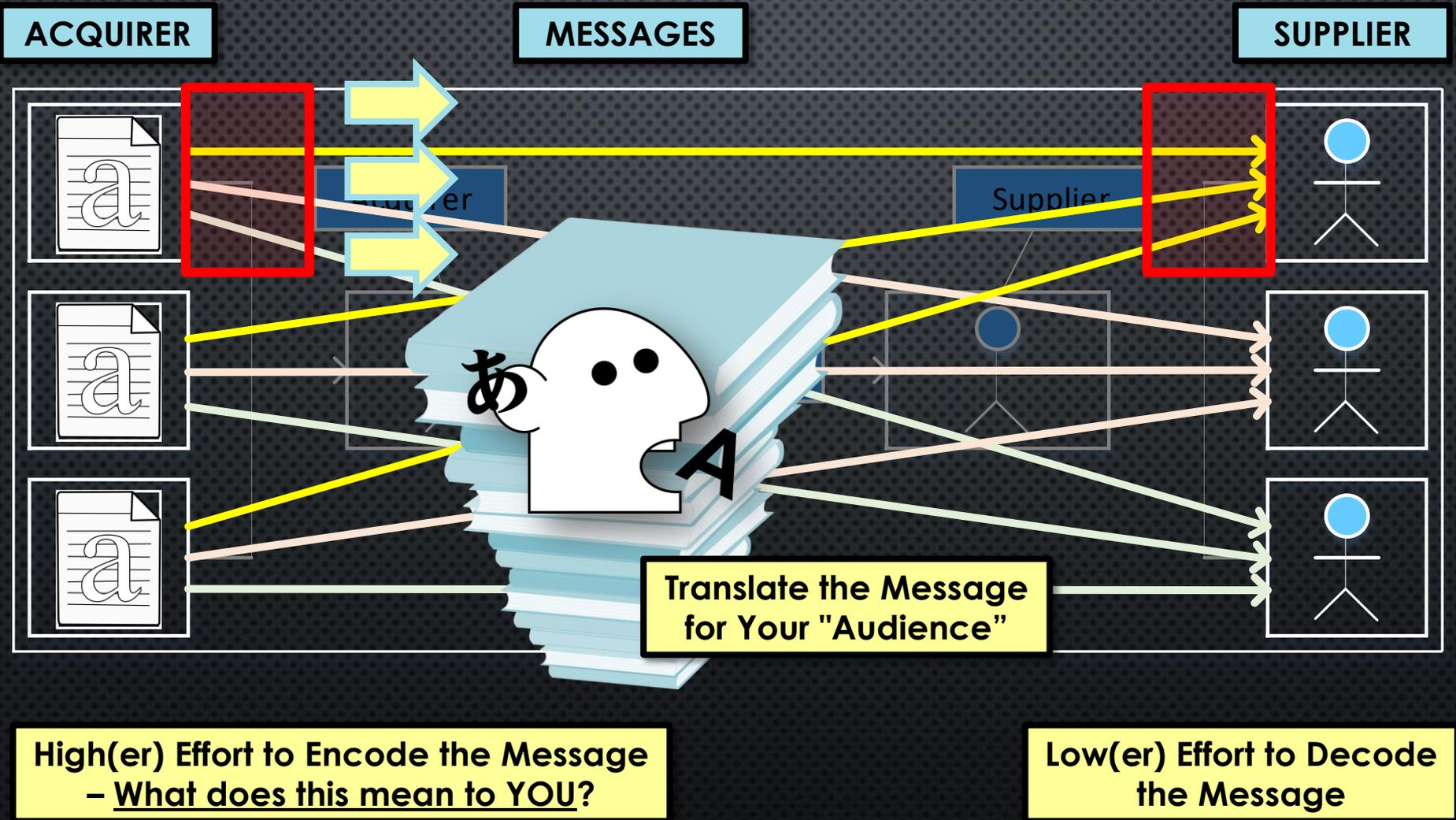


Low Effort to Encode  
the Message

High Effort to Decode the Message  
– What does this mean to ME?

# OFFERED SOLUTION

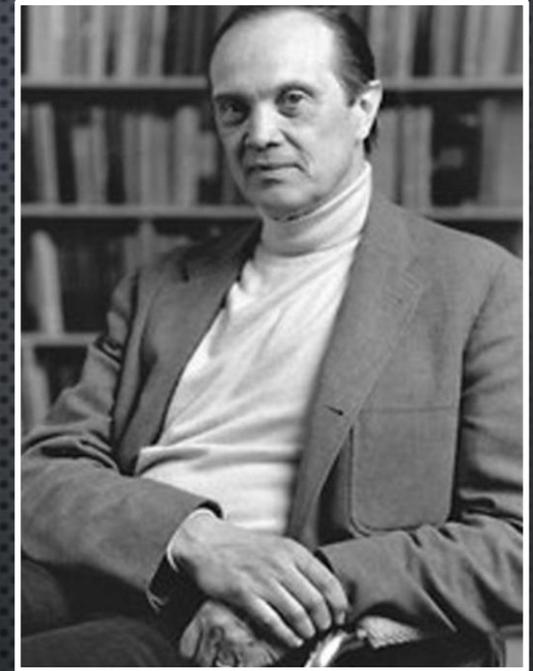
## ENCODING VS. DECODING EFFORT (CONT'D)



# OFFERED SOLUTION

## GOOD COMMUNICATION PRINCIPLES

- **Define What**
  - Expected Outcome / Deliverables
- **Define Who**
  - Allocate Responsibility / Accountability
- **Define When**
  - Specify the Due Date / Milestone
- **Define How (if desired)**
  - Define Activities, Constraints, etc.
- **Structure It**
  - Groups Requirements by Receiver
  - Consider the Magical Number  $7 \pm 2$

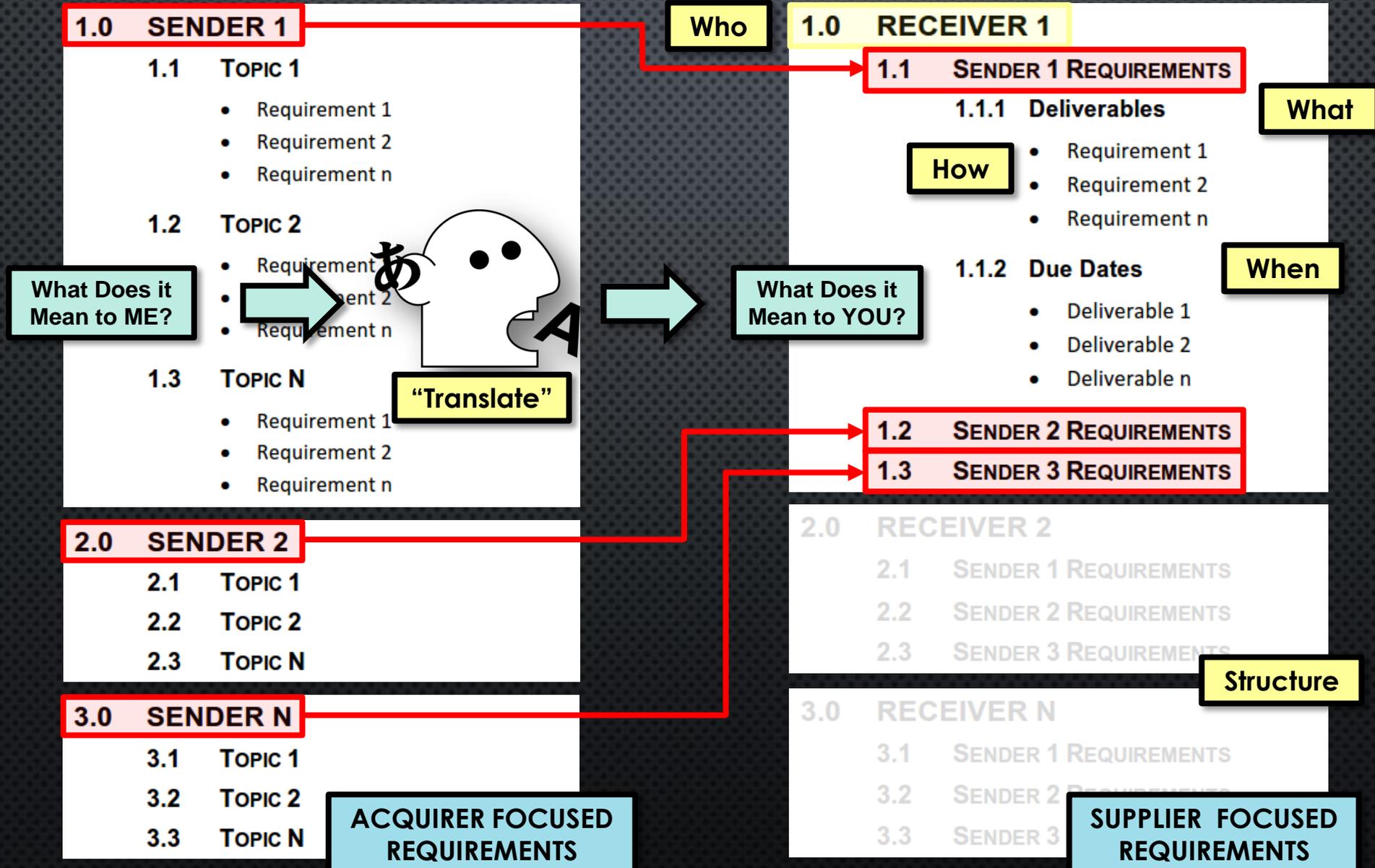


**"The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Processing Information"**  
**- George A. Miller**



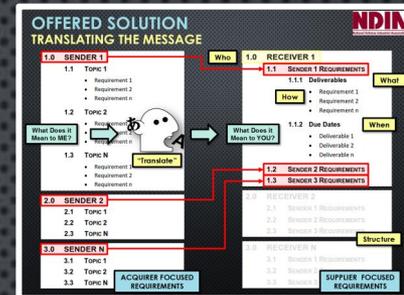
# OFFERED SOLUTION

## TRANSLATING & ORGANIZING YOUR MESSAGE



# OFFERED SOLUTION

## TRANSLATING YOUR MESSAGE (CONT'D)



### ACQUIRER

1.0 SENDER 1  
 1.1 REQUIREMENT 1  
 1.2 REQUIREMENT 2  
 1.3 REQUIREMENT N

2.0 SENDER 2  
 2.1 REQUIREMENT 1  
 2.2 REQUIREMENT 2  
 2.3 REQUIREMENT N

3.0 SENDER N  
 3.1 REQUIREMENT 1  
 3.2 REQUIREMENT 2  
 3.3 REQUIREMENT N

### ACQUIRER

1.0 SENDER 1  
 1.1 RECEIVER 1  
 1.2 RECEIVER 2  
 1.3 RECEIVER N

2.0 SENDER 2  
 2.1 RECEIVER 1  
 2.2 RECEIVER 2  
 2.3 RECEIVER N

3.0 SENDER N  
 3.1 RECEIVER 1  
 3.2 RECEIVER 2  
 3.3 RECEIVER N

### SUPPLIER

1.0 RECEIVER 1  
 1.1 SENDER 1  
 1.2 SENDER 2  
 1.3 SENDER N

2.0 RECEIVER 2  
 2.1 SENDER 1  
 2.2 SENDER 2  
 2.3 SENDER N

3.0 RECEIVER N  
 3.1 SENDER 1  
 3.2 SENDER 2  
 3.3 SENDER N

Allocate Requirements

Restructure Requirements

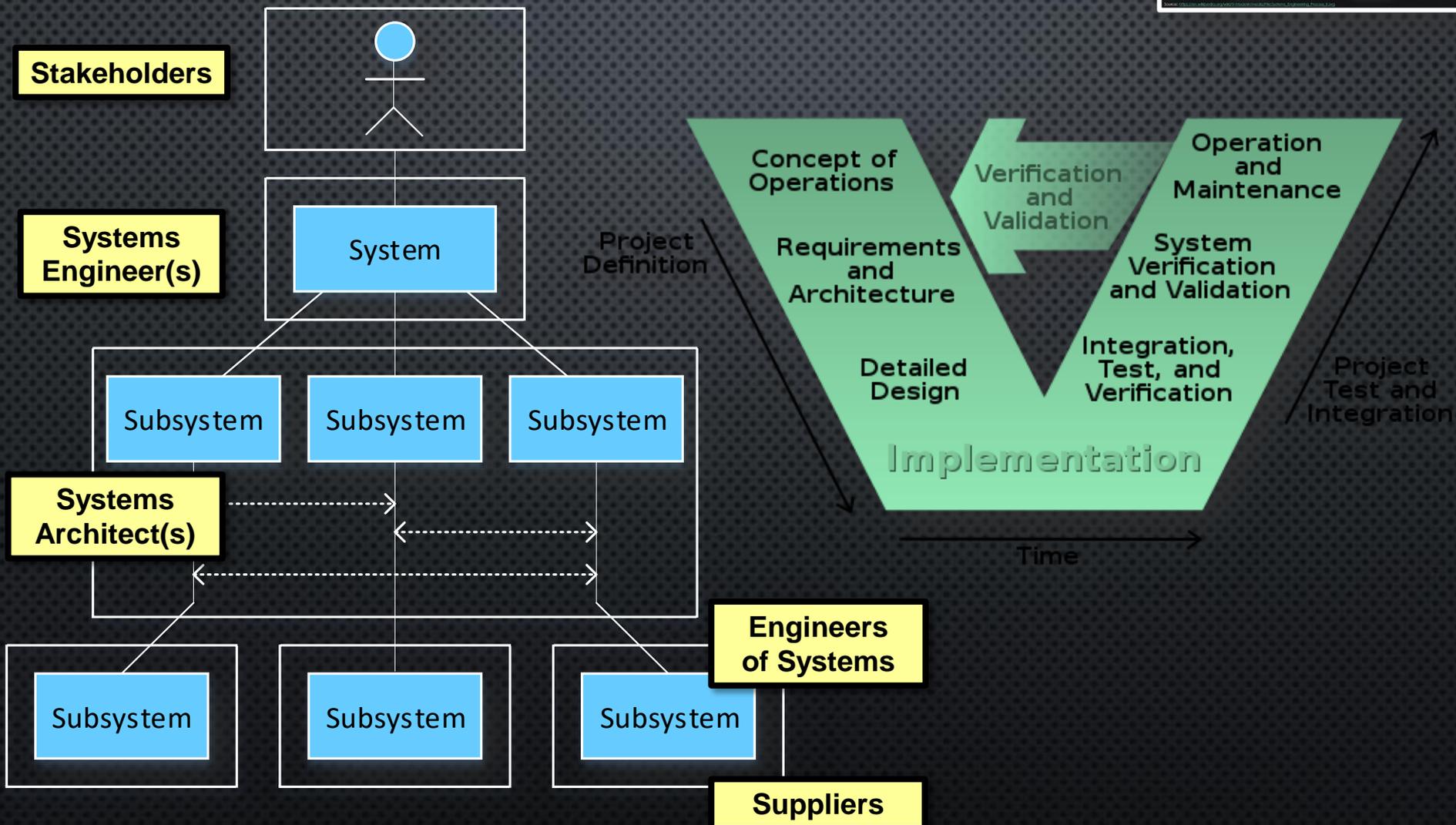
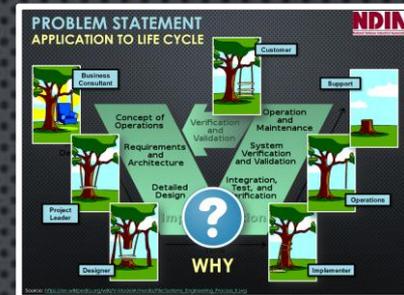
NO SUPPLIER CONSIDERATION

SOME SUPPLIER CONSIDERATION

FULL SUPPLIER CONSIDERATION

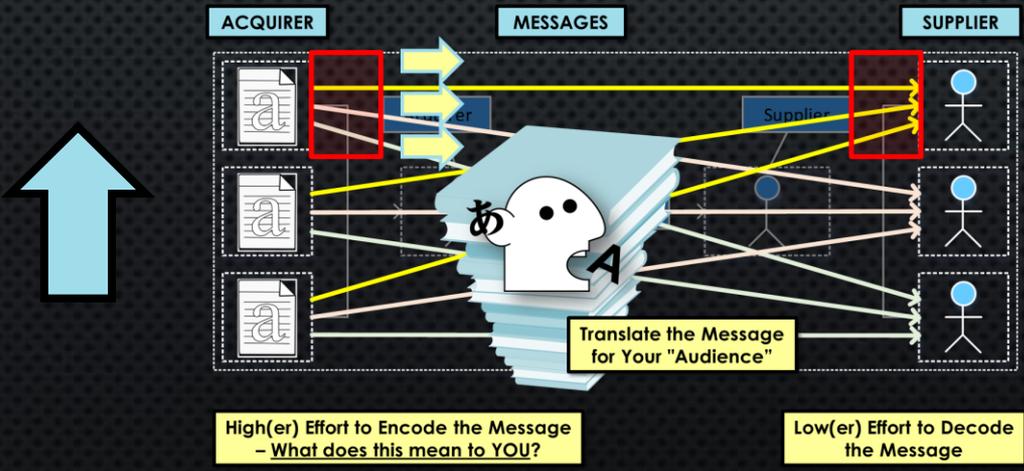
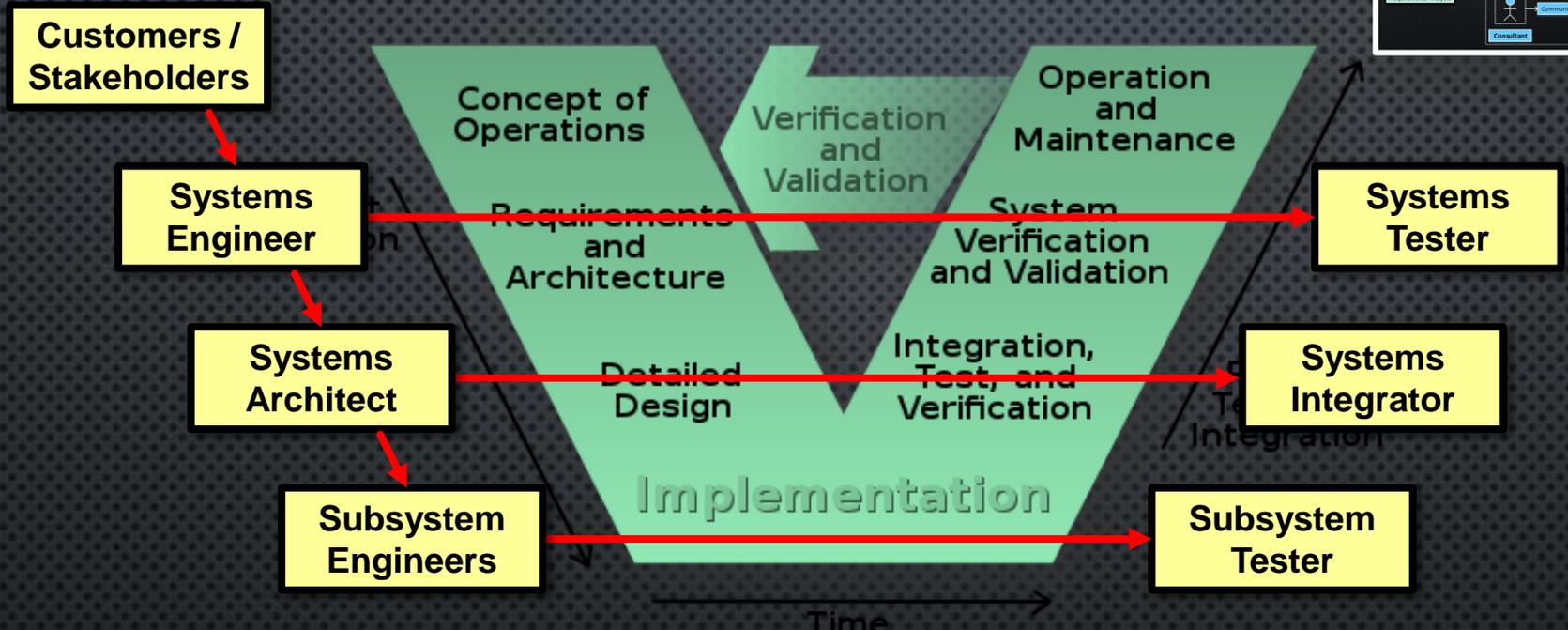
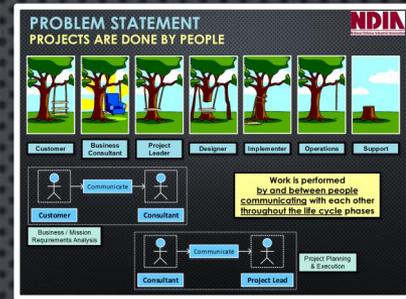
# OFFERED SOLUTION

## SYSTEMS DEVELOPMENT LIFE CYCLE



# OFFERED SOLUTION

## APPLICABILITY OF GOOD COMMUNICATION



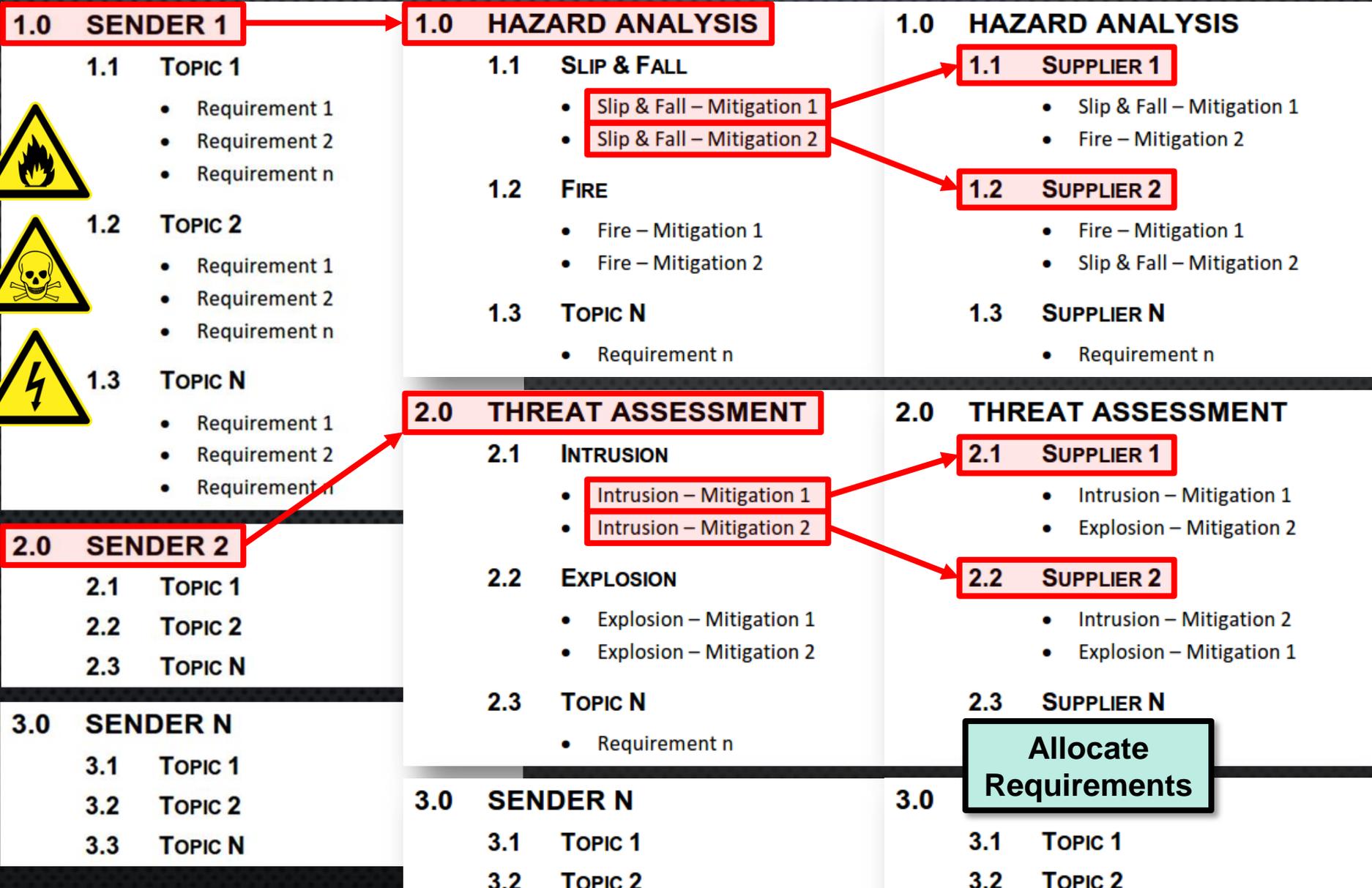
**Good & Effective Communication applies to all SDLC Phases**

# PROGRESS

- **Problem Statement**
  - Poor Project Performance
- **Offered Solution**
  - Improving Requirements Management Effectiveness using Communication Management Principles
- **Practical Example**
  - Safety & Security Stakeholder Requirements
- **Summary & Conclusions**

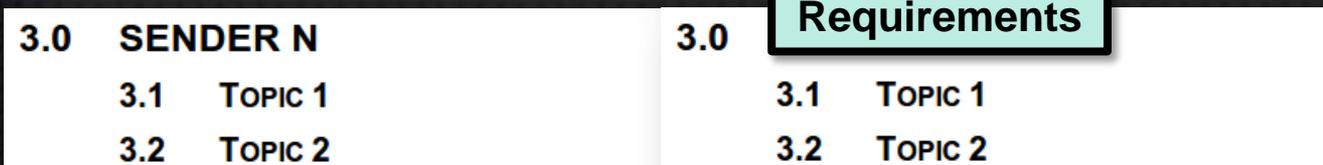
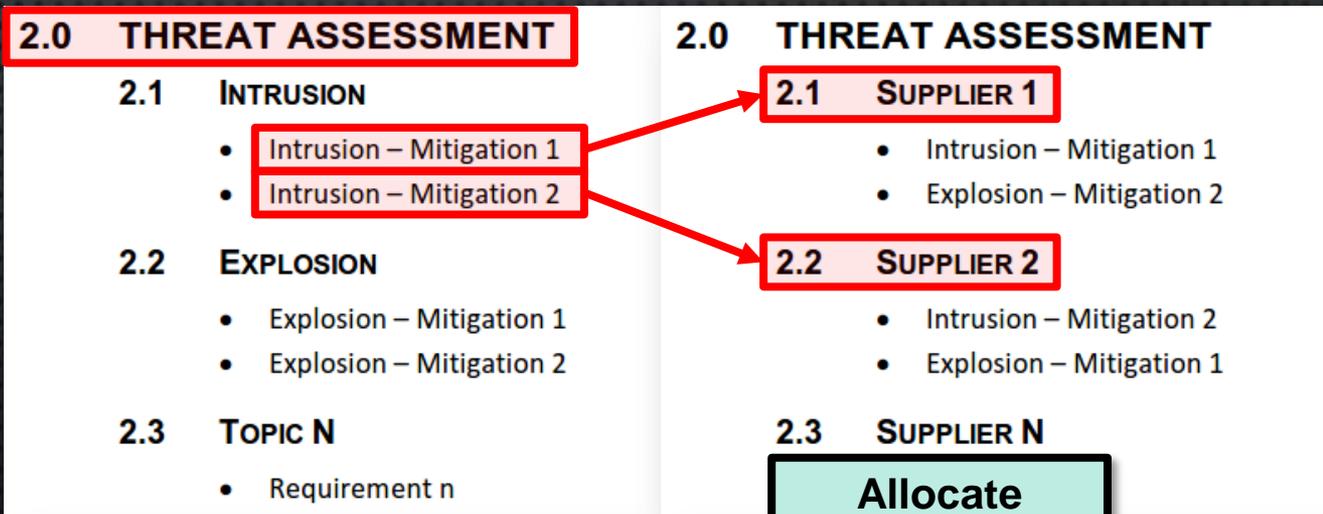
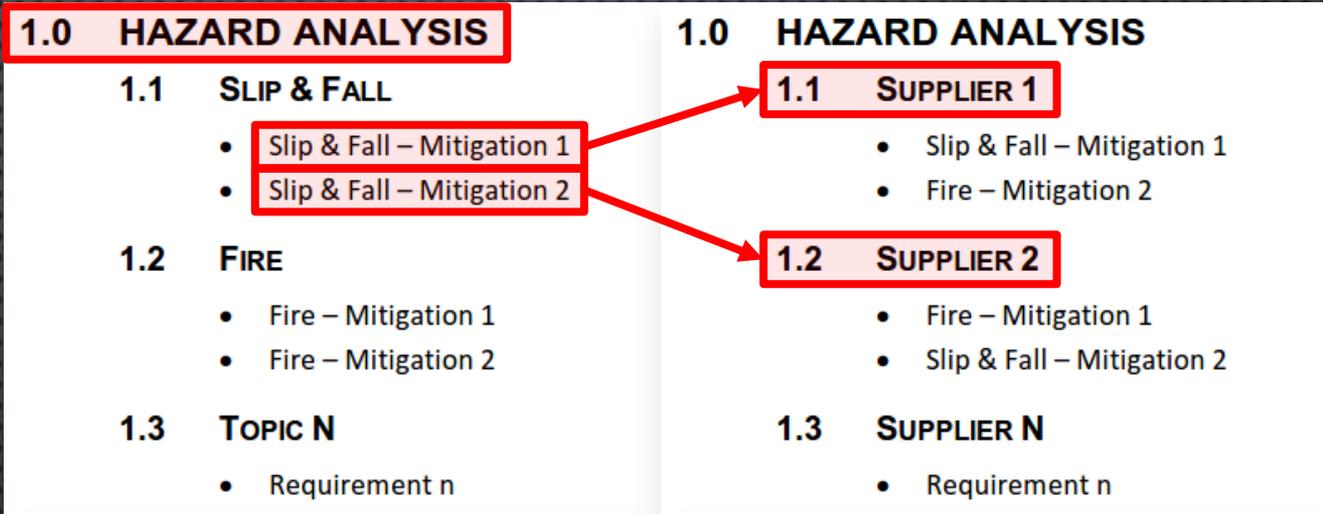
# PRACTICAL EXAMPLE

## STAKEHOLDER REQUIREMENTS: SAFETY & SECURITY



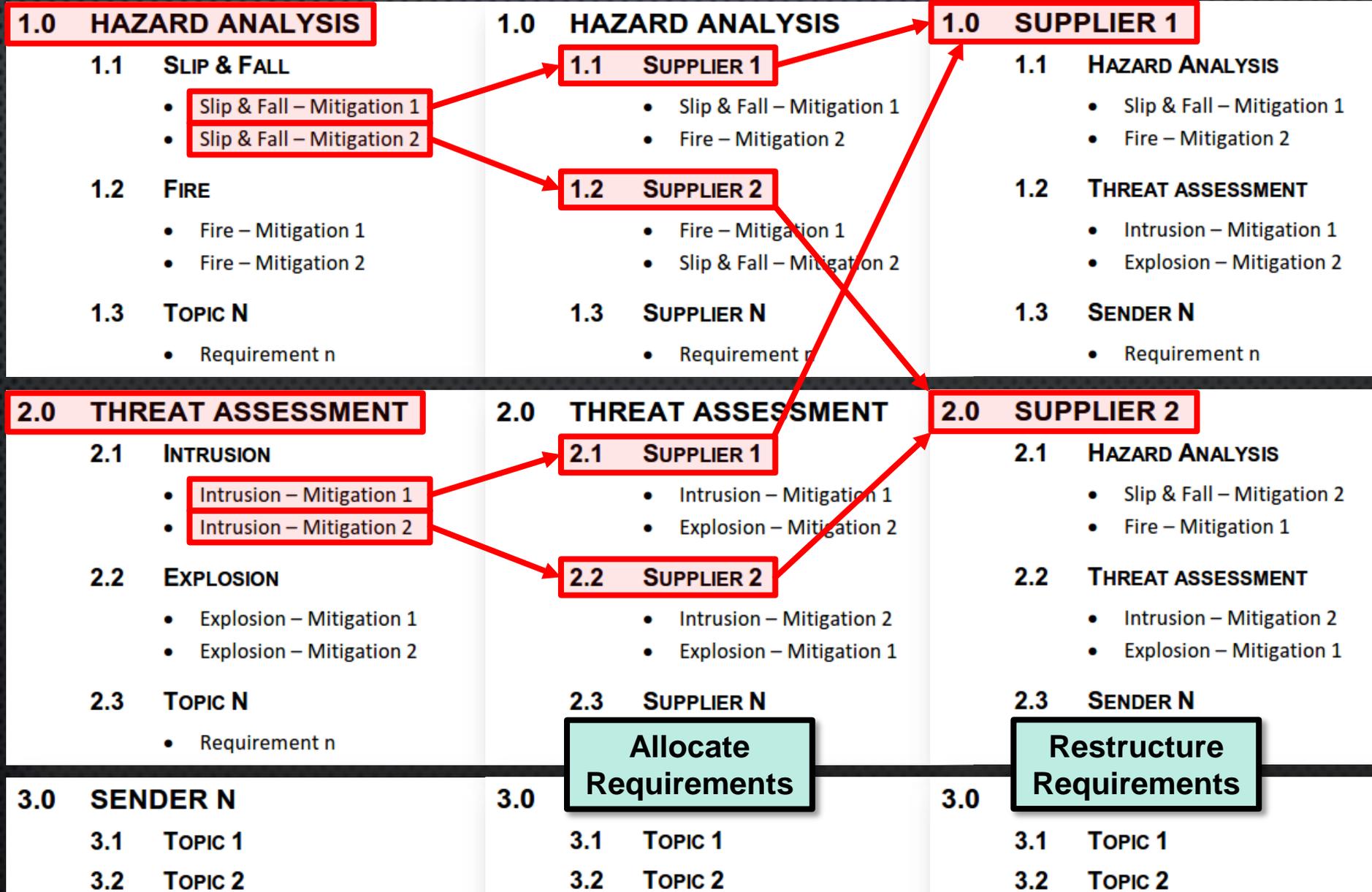
# PRACTICAL EXAMPLE

## STAKEHOLDER REQUIREMENTS (CONT'D)



# PRACTICAL EXAMPLE

## STAKEHOLDER REQUIREMENTS (CONT'D)



# PRACTICAL EXAMPLE

## STAKEHOLDER REQUIREMENTS (CONT'D)

### 1.0 HAZARD ANALYSIS

#### 1.1 SLIP & FALL

- Slip & Fall – Mitigation 1
- Slip & Fall – Mitigation 2

#### 1.2 FIRE

- Fire – Mitigation 1
- Fire – Mitigation 2

#### 1.3 TOPIC N

- Requirement n

### 2.0 THREAT ASSESSMENT

#### 2.1 INTRUSION

- Intrusion – Mitigation 1
- Intrusion – Mitigation 2

#### 2.2 EXPLOSION

- Explosion – Mitigation 1
- Explosion – Mitigation 2

#### 2.3 TOPIC N

**ACQUIRER FOCUSED REQUIREMENTS**

#### 3.1 TOPIC 1

#### 3.2 TOPIC 2

### 1.0 SUPPLIER 1

#### 1.1 HAZARD ANALYSIS

- Slip & Fall – Mitigation 1
- Fire – Mitigation 2

#### 1.2 THREAT ASSESSMENT

- Intrusion – Mitigation 1
- Explosion – Mitigation 2

#### 1.3 SENDER N

**This is what it means to YOU**

### 2.0 SUPPLIER 1

#### 2.1 HAZARD ANALYSIS

- Slip & Fall – Mitigation 2
- Fire – Mitigation 1

#### 2.2 THREAT ASSESSMENT

- Intrusion – Mitigation 2
- Explosion – Mitigation 1

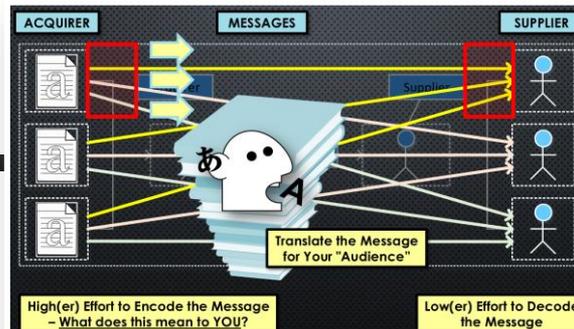
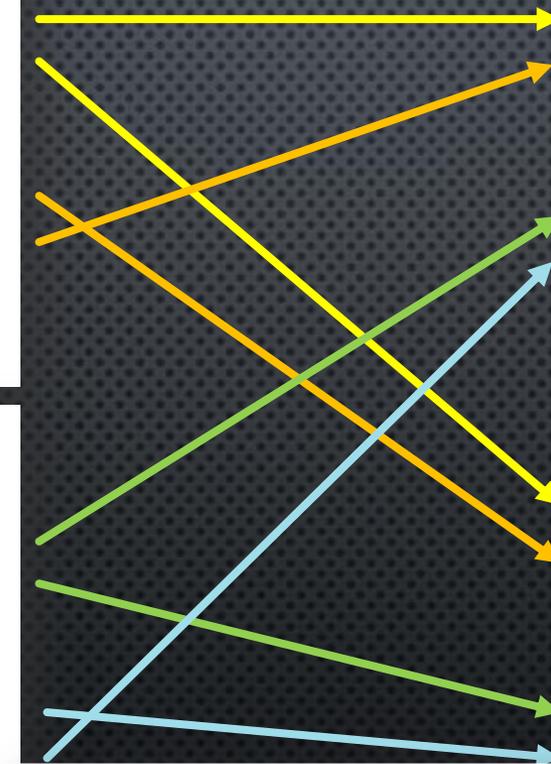
#### 2.3 SENDER N

**SUPPLIER FOCUSED REQUIREMENTS**

### 3.0 SUPPLIER 1

#### 3.1 TOPIC 1

#### 3.2 TOPIC 2



# PRACTICAL EXAMPLE

## SYSTEM REQUIREMENTS: SYSTEM #1

**1.0 SUPPLIER 1**

**1.1 HAZARD ANALYSIS**

- Slip & Fall – Mitigation 1
- Fire – Mitigation 2

**1.2 THREAT ASSESSMENT**

- Intrusion – Mitigation 1
- Explosion – Mitigation 2

**1.3 SENDER N**

- Requirement n

**1.0 SYSTEM 1**

**1.1 HAZARD ANALYSIS**

- Slip & Fall – Mitigation 1
- Fire – Mitigation 2

**1.2 THREAT ASSESSMENT**

- Intrusion – Mitigation 1
- Explosion – Mitigation 2

**1.3 SENDER N**

- Requirement n

**1.0 SYSTEM 1**

**1.1 SUBSYSTEM 1**

- Slip & Fall – Mitigation 1

**1.2 SUBSYSTEM 2**

- Fire – Mitigation 2

**1.3 SUBSYSTEM 3**

- Intrusion – Mitigation 1

**1.4 SUBSYSTEM 4**

- Explosion – Mitigation 2

**2.0 SUPPLIER 2**

**2.1 HAZARD ANALYSIS**

- Slip & Fall – Mitigation 2
- Fire – Mitigation 1

**2.2 THREAT ASSESSMENT**

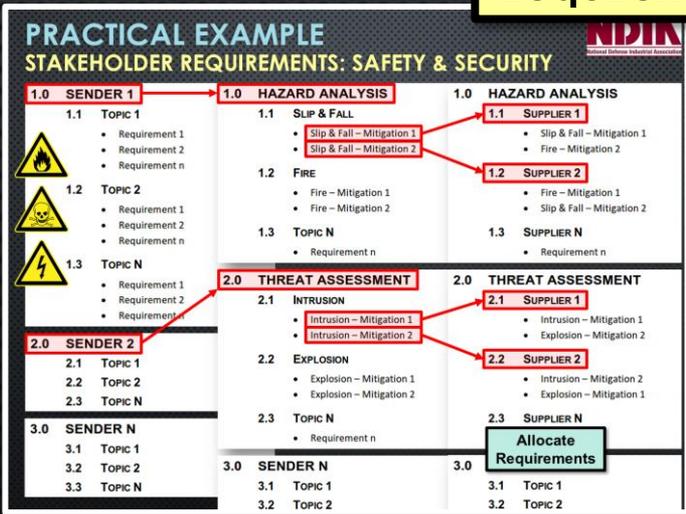
- Intrusion – Mitigation 2
- Explosion – Mitigation 1

**2.3 SENDER N**

- Requirement n

**Further Allocate System 1 Requirements to Subsystems**

**SUPPLIER FOCUSED REQUIREMENTS**

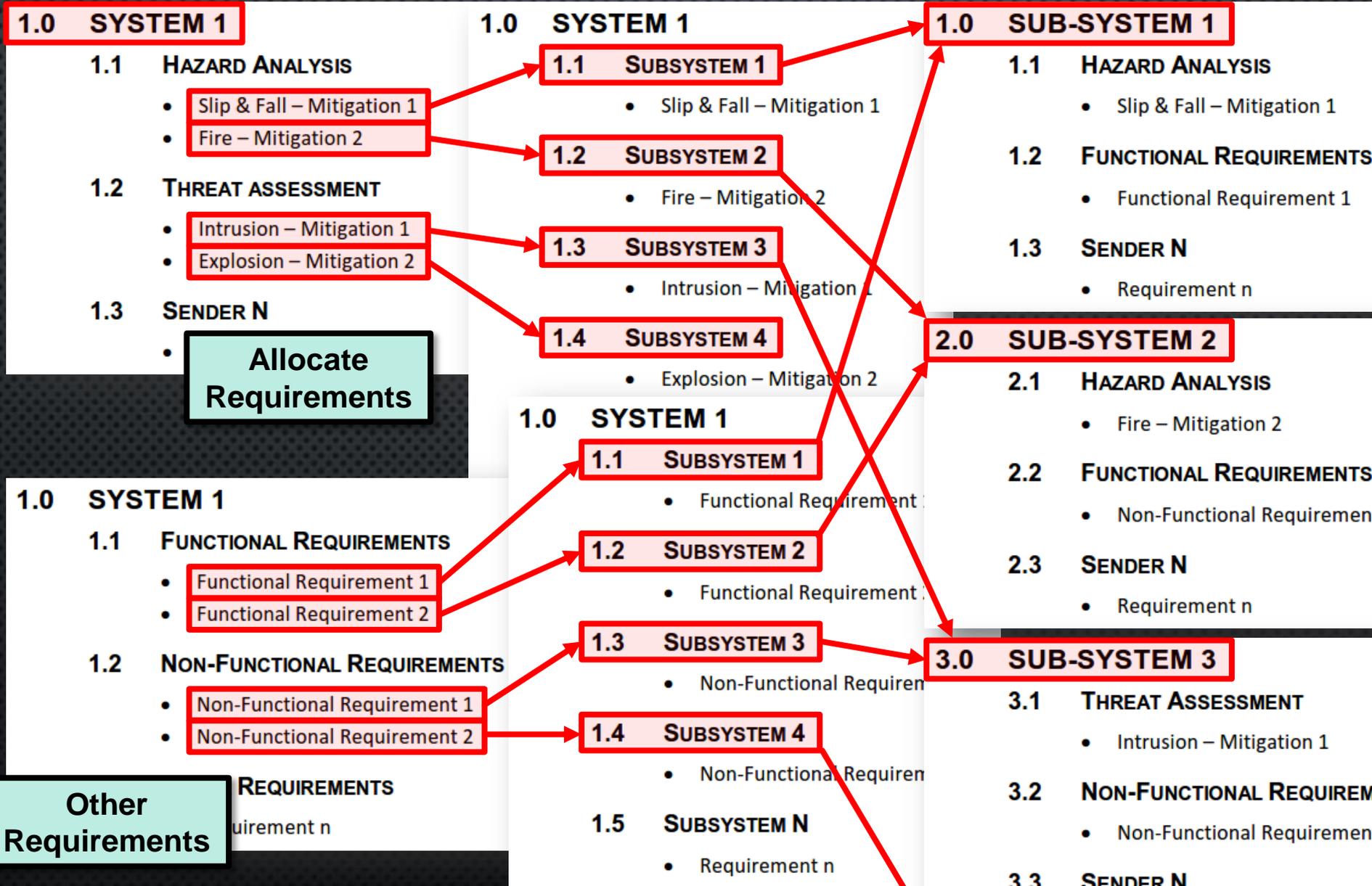


**3.1 TOPIC 1**

**3.2 TOPIC 2**

# PRACTICAL EXAMPLE

## SYSTEM REQUIREMENTS: SYSTEM #1 (CONT'D)



# PRACTICAL EXAMPLE

## OTHER USES THROUGHOUT THE LIFE CYCLE

### 1.0 MILESTONES

#### 1.1 MATERIAL SOLUTION ANALYSIS PHASE (MS A)

- Requirement 1
- Requirement 2
- Requirement n

#### 1.2 TECHNOLOGY DEV

- Requirement 1
- Requirement 2
- Requirement n

#### 1.3 ENGINEERING & M

- Requirement 1
- Requirement 2
- Requirement n

#### 1.4 OTHER MILESTONE

- Requirement n

### 1.0 DELIVERABLES

#### 1.1 CONCEPT OF OPERATIONS

- Requirement 1
- Requirement 2
- Requirement n

#### 1.2 SYSTEM REQUIREM

- Requirement 1
- Requirement 2
- Requirement n

#### 1.3 SYSTEM ARCHITEC

- Requirement 1
- Requirement 2
- Requirement n

#### 1.4 OTHER DELIVERAB

- Requirement n

### 1.0 TESTING

#### 1.1 FACTORY TESTING

- Requirement 1
- Requirement 2
- Requirement n

#### 1.2 INTEGRATION TESTING

- Requirement 1
- Requirement 2
- Requirement n

#### 1.3 SYSTEM TESTING

- Requirement 1
- Requirement 2
- Requirement n

#### 1.4 OTHER TESTING

- Requirement n

This is what it means to YOU!

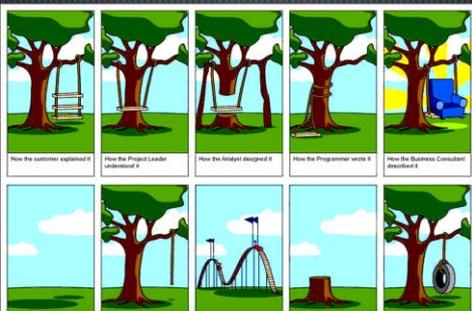
# PROGRESS

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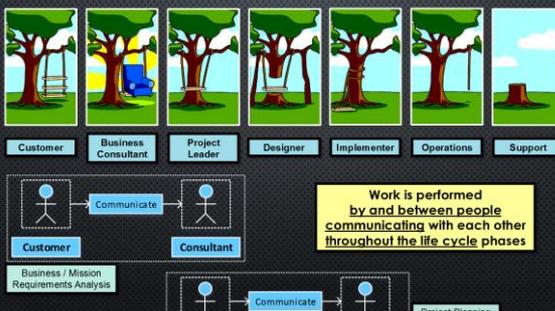
# SUMMARY & CONCLUSIONS

## SUMMARY

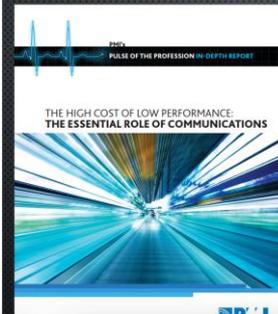
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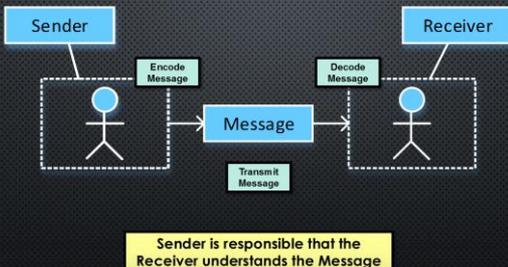
### PROBLEM STATEMENT PROJECTS ARE DONE BY PEOPLE



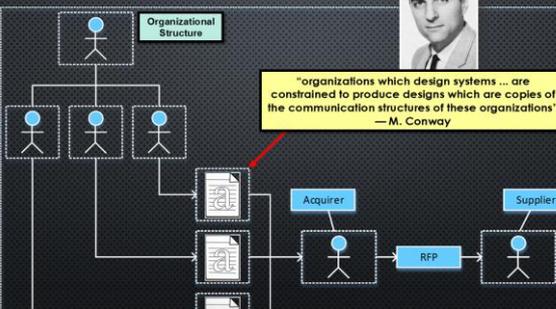
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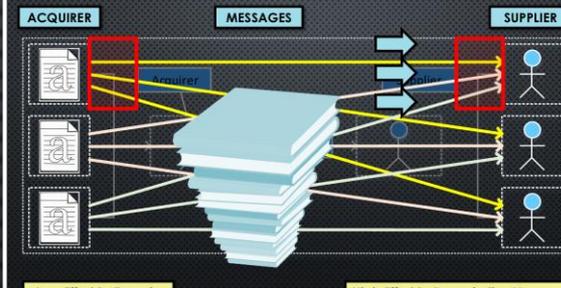
### OFFERED SOLUTION PRINCIPLES OF COMMUNICATION



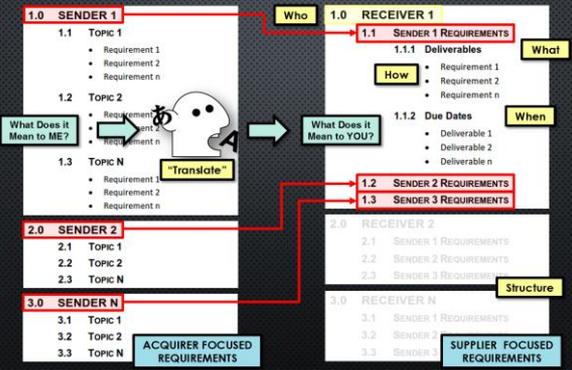
### OFFERED SOLUTION MULTIPLE ACQUIRERS



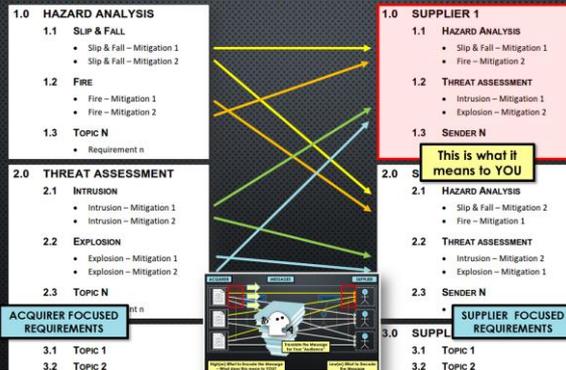
### OFFERED SOLUTION ENCODING VS. DECODING EFFORT



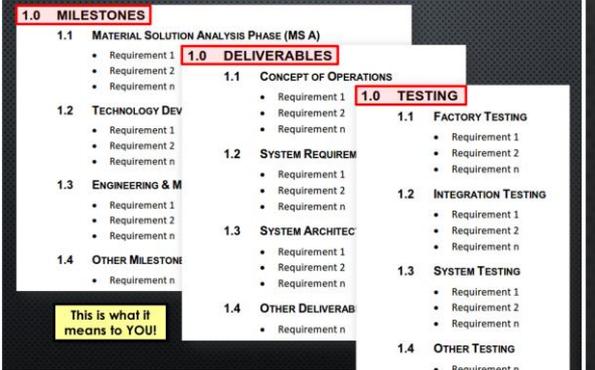
### OFFERED SOLUTION TRANSLATING THE MESSAGE



### PRACTICAL EXAMPLE STAKEHOLDER REQUIREMENTS (CONT'D)



### PRACTICAL EXAMPLE OTHER USES THROUGHOUT THE LIFE CYCLE



# SUMMARY & CONCLUSIONS

## THINK OF YOUR AUDIENCE!

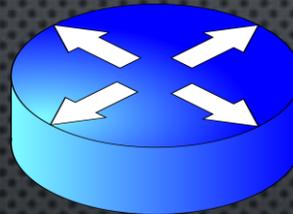


### ACQUIRER

- 1.0 SENDER 1
  - 1.1 REQUIREMENT 1
  - 1.2 REQUIREMENT 2
  - 1.3 REQUIREMENT N

- 2.0 SENDER 2
  - 2.1 REQUIREMENT 1
  - 2.2 REQUIREMENT 2
  - 2.3 REQUIREMENT N

- 3.0 SENDER N
  - 3.1 REQUIREMENT 1
  - 3.2 REQUIREMENT 2
  - 3.3 REQUIREMENT N



Translate YOUR Message

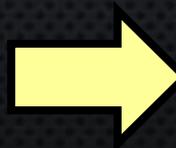
### SUPPLIER

- 1.0 RECEIVER 1
  - 1.1 SENDER 1
  - 1.2 SENDER 2
  - 1.3 SENDER N

- 2.0 RECEIVER 2
  - 2.1 SENDER 1
  - 2.2 SENDER 2
  - 2.3 SENDER N

- 3.0 RECEIVER N
  - 3.1 SENDER 1
  - 3.2 SENDER 2
  - 3.3 SENDER N

What does it mean to ME



What does it mean to YOU

# SUMMARY & CONCLUSIONS

## QUESTIONS & ANSWERS



**THANK YOU FOR  
YOUR ATTENTION**

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