

# Managing Priorities:

Deadline Pressure Control

INCOSE, LAS VEGAS

Thursday, 1st August 2002

Session 1315-1520

This talk 20 minutes +5

See paper in proceedings

# Priority: my definition

- Priority is claim on limited (or scarce) resources.
- Priority is the relative right of a competing requirement to constrained resources.
- If resources were unlimited, there would be no need to prioritize things.
  - You can have it all.
- Latent priority is
  - claim on unallocated (but latent) resources,
  - which *might* be allocated if the benefits of doing so are agreed to justify the allocation.

# I would like to argue that

- *numeric subjective weighting* is not the only alternative for evaluating and documenting stakeholder priorities
- there are *many other devices* available, than , for determining, specifying and evaluating priority: most of which are always better than subjective weighting.
- it is time we threw off the shackles of subjective weights and gave both students and practicing engineers something *more useful and realistic* as a tool.

# I am assuming a realistic systems engineering environment with:

- multiple stakeholders, probably ignorant of the others and their values
- multiple competing values from *same* stakeholder
- ignorance of the real resource costs of delivering *their* values
- ignorance of the *system-wide available* resources
- ignorance of the *future* in which resources, values, authority, power and technology will change.

## Some problems with the **WEIGHTING** process for determining priority?

- 1. Information ‘Overload’.** There is a great deal of information about a requirement, that any reasonable person would want to know and use in order to determine the priority. This is not made available to us, or even specified.
- 2. ‘One-off’ Weighting.** The weightings tend to be ‘frozen’, they are not reassessed frequently throughout a project. ‘Real’ priority is not that static
- 3. Lack of Consideration of Resources.** Resources are not considered when allocating weights
- 4. An Individual Stakeholder’s Viewpoint is Limited.** A person’s subjective judgement depends on experience, access to information, and evaluation of that information. Which of 30 stakeholders sets the weight?

# SUBJECTIVE WEIGHTING AND EVALUATIONS METHODS ARE WEAK BECAUSE

- 1. THEY DO NOT SCALE UP WELL:
- 2. WEIGHTS ARE STATIC AND ARBITRARY:
- 3. INSUFFICIENT REALISTIC INFORMATION:
- 4. LEVEL OF PERCEPTION

# 1. DOES NOT SCALE UP WELL:

- The real number of requirements in real projects is large, and subjective weighting is an impractical scheme for understanding their priority.

The reason for this is that :

- a large number of pieces of information ('priority signals') may be required for each requirement, before priority analysis can be made.
- the subjective judgments *become invalid* when options and conditions *change*,
  - so you risk having to get *all the judgments* done again.
- So, subjective weighting schemes can and do handle any arbitrary quantity of alternatives.
  - But they rely on premature judgement of priority.
  - They rely on subjective judgement comparing options that can be changed.
  - So, when trying to handle a large number of priority elements, they will cost more than methods which focus on capturing the basic information (values and authority), and making judgments on that basis.

## 2. WEIGHTS ARE STATIC AND ARBITRARY:

- ‘Weightings’ and ‘subjective evaluations’ are *subjective*: better than nothing,
  - but there is a more *objective* alternative (*real* performance values and real costs).
  - Real priority (example your priority for sleep or liquid) is not static.
  - It is *dynamic* and *computable*, depending on *satisfaction* of needs, and *residual* scarce resources.

### 3. INSUFFICIENT REALISTIC INFORMATION:

- There is a great deal of *additional information* about a specification, that any reasonable person would want to know and use in order to determine the priority.
  - For example,
    - the delivery timing,
    - the geographical positioning,
    - the assumptions,
    - the conditions,
    - the level of risk (in real terms not artificial ones),
    - the level of authority of the people behind a specific requirement,
    - the known set of stakeholders behind a requirement and much more.

# 4. LEVEL OF PERCEPTION

- Levels: the priority of a requirement will differ, *depending on which level of the life cycle you are at* (architecture, project management, maintenance etc.).
  - We need to have realistic ways to reflect this.
    - The conventional methods seem to fix their priority at one level of view, the person making the subjective weighting or pair-wise comparison judgement.
    - The methods I am suggesting focus on collecting facts about multiple stakeholder values and their authority levels.
      - Using this raw information,
        - » we can look at a view of any interesting subset of the systems specification,
        - » and using any policy of prioritization (value, value to cost, political favor etc.),
        - » at any time we wish can determine the relative priority of any set of ideas in question.

# What are the rules of determining priority?

- **constraints** first:
  - there are a variety of constraint types [CE, Glossary], and they each will have different authority and economic consequences – however constraints are the *first* level of decision-making about priorities. Restrictions, Survival level, Fail Level are 3 constraint types.
- **stakeholder value**:
  - specifications (requirements and design) can be prioritized depending on the value they produce. This should be determined, less by subjective '1 to 10' scales, and more by the *real* performance levels delivered, and the consequential *value* of that performance level in the real world.
- **stakeholder value in relation to cost**:
  - in other words return on investment (ROI), profit and net value. Again the cost should be realistically determined as life cycle cost including maintenance, adaptability and decommissioning costs.
- **value to cost in relation to risk**:
  - the most pessimistic (worst imaginable case) values for stakeholder value and cost can be used to evaluate alternative choices. This would reduce the frequency of bad decisions due to unwarranted optimism.
- **current value to current cost, with regard to current results in place, current stakeholders, and current resources available**.
  - – using the Evolutionary method of collecting this data during the project, step by step. This is arguably the best basis for determining priority. It is based on reality rather than theory, and it enables engineers to consider circumstances that would initially be unforeseen and unforeseeable.

Let me summarize with some principles of priority determination.

- 1. Priority is what has first claim on limited resources.**
- 2. Stakeholder requirements are the basis for determining priorities.**
- 3. Benefit to Cost Ratios help determine which requirement is addressed next.**
- 4. Priority decisions should be based on a detailed set of information about the options**
- 5. Constraints are your first priority.**
- 6. Targets are your second priority.**
- 7. Priority needs to be determined periodically, not simply at the beginning of a project.**
- 8. The ‘most threatening’ gap to a requirement level has highest priority, other things being equal. By ‘most threatening’, I mean the one threatening the biggest risk in terms of consequences to the organization**
- 9. More-objective requirement statements (fact-based, citing the supporting evidence, measurement based from past relevant experience) are better than more-subjective statements (such as opinions without facts or measures).**
- 10. Priority should be determined based on risks, benefit and cost.**

# Conflicts and Priorities

- Relax!
  - No matter what you do
  - the ‘demands’ from all your ‘stakeholders’
  - (Customers, Employees)
  - will ALWAYS exceed your capacity to satisfy them.

## *Manage Priorities*

- There is nothing you can do about that situation,
  - *except to manage priorities better,*
  - so that you get the greatest value for stakeholders
  - in relation to your scarce resources.

# Never enough resources!

- Yes, you will ‘NEVER’ have enough resources either!
- Just relax!
- Don’t panic.
- Don’t work harder,
  - work smarter.
- Let me give you some advice on ‘smarter’
  - if you feel you want it.

# *‘Priority’ management*

- is *central* to all forms of technical and organizational management.
- If you have *infinite* resources, ‘priority’ is not interesting. You can *do it all*.
- So, the ‘*more scarce*’ our various resources (people, time, money) are,
  - the more we *need to manage* priorities.
- ‘Priority management’ is simply
  - ‘getting the best out of your scarce resources’.

# The highest priority for human survival is:

- Water
- Air
- Food



# Did you answer the 'right question'?

- If you answered 'air'
- You were probably answering the question:
- "Which of these 3 things, if totally denied would kill a human fastest"
- That was not the question!
- *Rule One:*
  - *Listen to the Question*
  - *Make sure you understood it*
  - *Answer the question asked*


August 1, 2002

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*The highest priority for human survival is:*

- Water
- Air
- Food



1

# Is your answer valid if:

- We are in the Death Valley Desert 
  - And we have enough air, but have no water and ate the rest of our food 5 days ago?
- You are on a hunger strike (Ghandi) in the 43rd Day and Nehru is worried?

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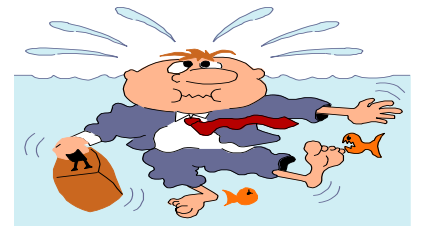
# Problems with the Question

- No information was given on ‘Requirements’
  - At ‘Survival level’
- No information was given on degree of satisfaction of the requirements.
  - ‘Goal level’



# Problems with your mode of answering:

- You answered without asking necessary information
  - (requirements, degree of satisfaction)
- This might be taken as an *authoritative* demand
  - (you are the manager, you *did not hesitate* to give a clear answer)
- You did not even ask ‘*why the question was asked*’
  - My answer: to trick you into unreasonable, dangerous behavior in public!
  - *Next time* your enemy might pull this trick!



# Problems with your answer content:

- Based on insufficient information
  - Needs (requirements, objectives)
  - Satisfaction degree (up to now)
  - Resources *available* (to satisfy *all* needs)

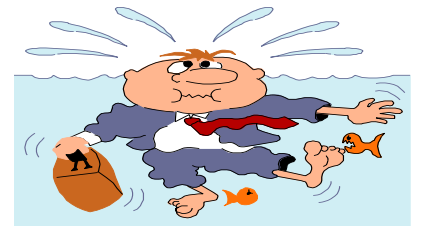


No limits stated as to:

- resources *to be used* for this *one* need
- time to satisfy the need before ‘death’ (TTM!)
- degree of satisfaction of your ‘priority’ choice
  - You risk *oversatisfaction* (no ‘*added value*’)
  - At the expense of *other* vital needs (food, water)

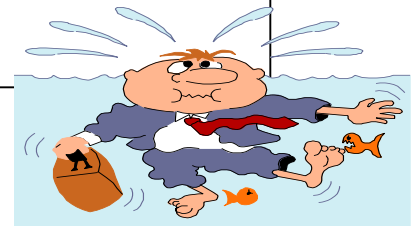
# General observations on ‘priorities’

- They are *multiple* Critical Factors simultaneously
- Critical Factor’s needs *vary* from project to project
- CF’s ‘degree of satisfaction’ *varies* as time goes by
- The ‘biggest gap’ *must* get our scarce resources
  - Otherwise we risk exhausting scarce resources *before* ‘survival’ levels are achieved for some critical factors
- The ‘real’ (‘Fundamental Objectives’) priority is:  
**SURVIVAL**
  - Food, water, air are the ‘Strategic Objectives’



# Good advice on Priority Analysis

- Specify all critical needs as numeric values
  - Qualify these levels by [who, where, when, IF]
- Determine *current* degree of satisfaction of each critical need
- Be prepared to re-analyze when conditions have changed:
  - Levels (for survival and success)
  - Qualifiers [who, where, when, IF]
  - Satisfaction levels currently



# Good advice on Priority Satisfaction Action for managers

- Focus on serving Survival-critical, biggest gaps
- Act to maximize effects/resources on several Critical Factors at once
- Get rapid feedback on your last actions
- Get feedback early and frequently
- Learn from ‘surprising deviations from expectations’

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# Priority Determination

## Establish and specify Stakeholder values and authority/power structure

**Determine project stakeholders**  
Internal and External

**Determine stakeholder values (requirements) and specify them in detail and to a high standard of testability and intelligibility**

**Document the relationships for the values (requirements) to levels of authority (law, architect, product planned, contract)**

**Determine resource assumptions (which resources will be available and when)?**

## Determine relative priority (immediate claim on resources)

**Select a viewpoint level to judge priority from (project, product line, engineer)**

**Consider all relevant defined constraints and dependencies at this decision-point moment. (what must you do, what can't you do)**

**Select prioritization policy. (what do we want to do next? Value, Value / cost, Politics?)**

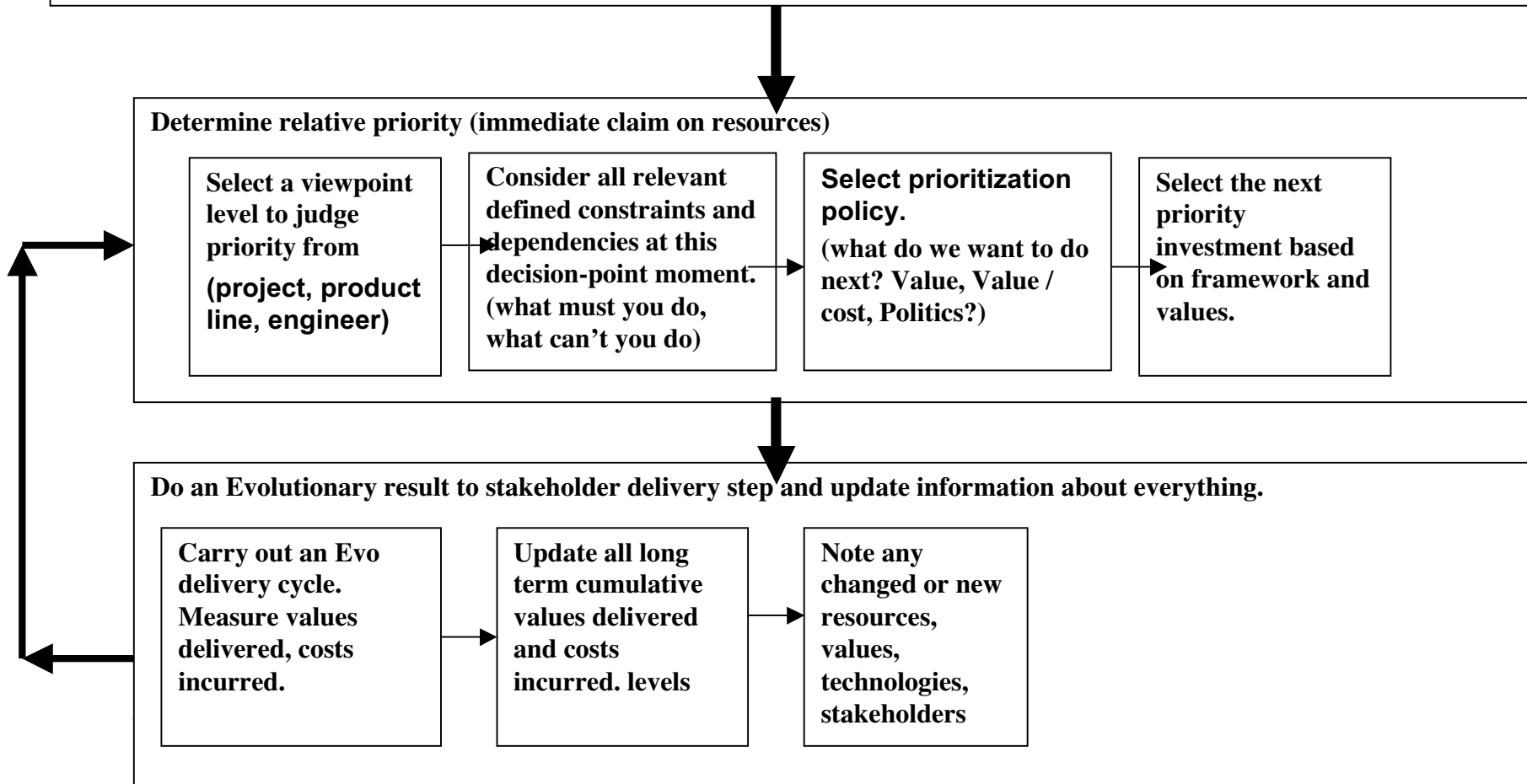
**Select the next priority investment based on framework and values.**

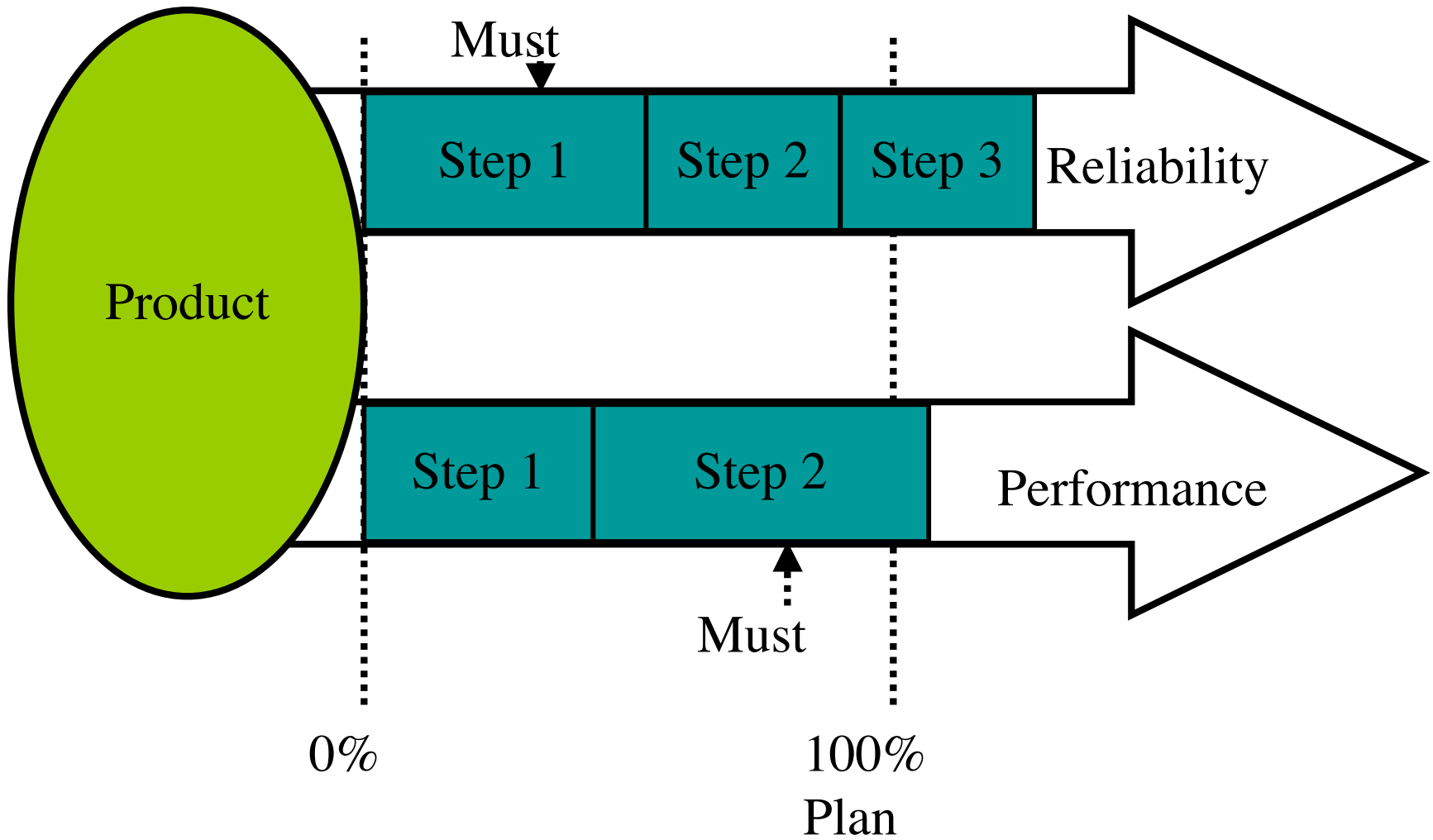
## Do an Evolutionary result to stakeholder delivery step and update information about everything.

**Carry out an Evo delivery cycle. Measure values delivered, costs incurred.**

**Update all long term cumulative values delivered and costs incurred. levels**

**Note any changed or new resources, values, technologies, stakeholders**





# Dynamic P

'Reliability' now has priority because it has not reached 'satisfaction' level yet.

Must

Plan

Step 1

Step 2

St.3

Reliability

Must

Plan

Step 1

Step 2

Performance

Product

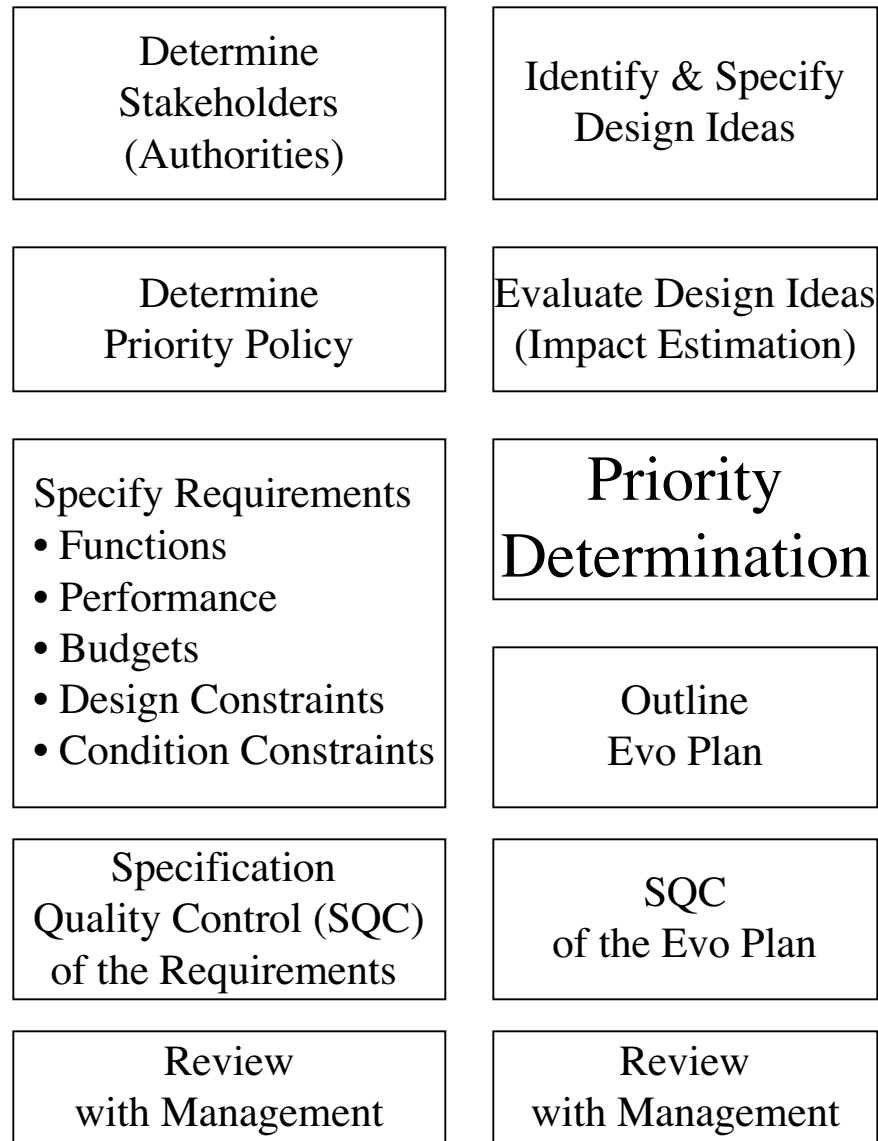
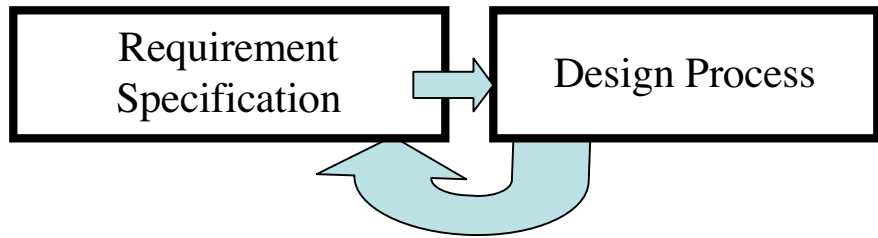
'Performance' now has priority because it is not at 'survival' level yet

*Evolutionary Results Delivery Method  
Project Planning Policy  
(a priority mechanism)*

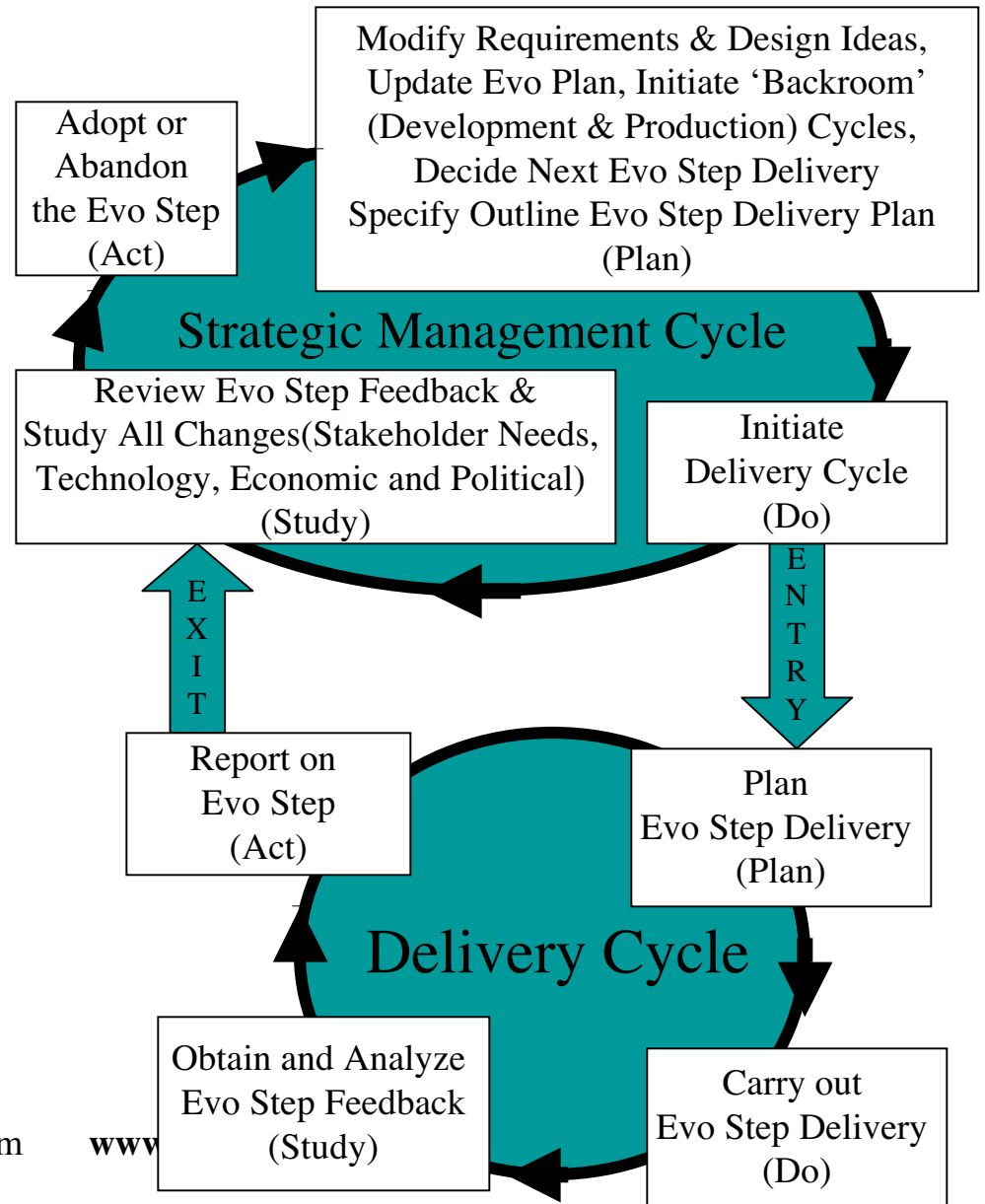
- **PP1.(Budget)** No project cycle shall exceed **2%** of total **budget** before delivering measurable results to a real environment.
- **PP2. (Deadline)** No project cycle will exceed **2%** of total **project time** (one week for a year's projects) before it demonstrates practical measurable improvement, of the kind targeted.
- **PP3.(Priority)** Project cycles which deliver the most **planned results** to **customers**, for the resources they claim, shall be delivered first, to the customer.

# Dynamic Priority Principles

- Priority: is something which has strongest claim on your limited resources.
- Priority is set by your “targets” and “Constraints”
- Priority is determined ‘as time goes by’
  - by need for survival (distance to constraint levels)
  - then by need to succeed (distance to target levels)
- when all Goal levels are achieved
  - there is nothing which has claim on your resources
  - you are done with the project
  - free remaining resources for other projects



# Evolutionary Project Management



# Priority Management: Some practical power tools



- *Impact Estimation Tables*
- *Evolutionary Delivery Project Management*

## Some more tools

- *For establishing your priorities*
- *In both organizational development*
- *And software projects*

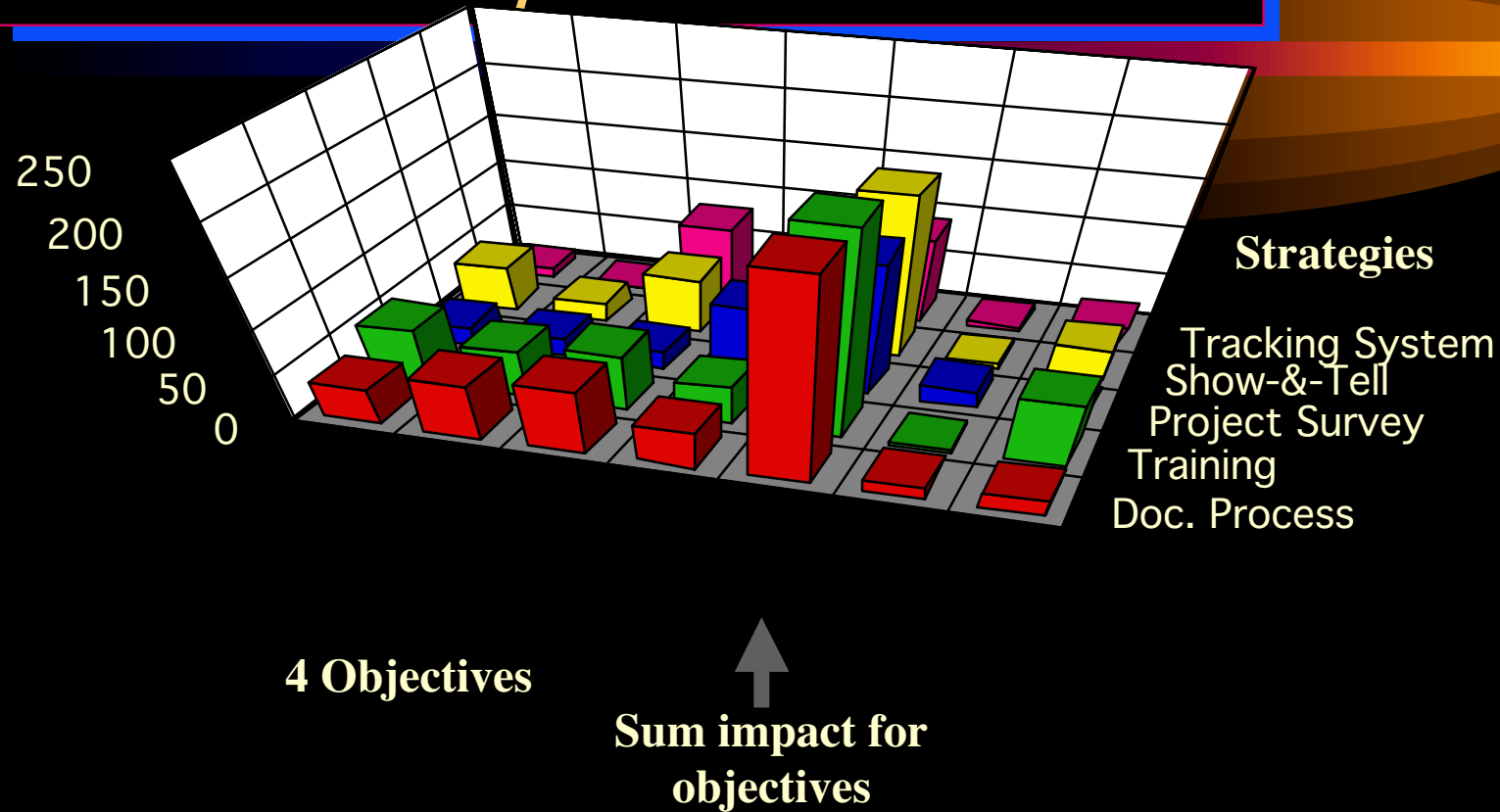
# Impact estimation Tables

- *Understanding the 'gap' between your Goals and your current status*
- *Biggest Gap is highest priority*
  - *If not then you risk 'sub-optimization'*
    - *(doing too much of a good thing, which more vital concerns cause failure)*

# Impact Estimation for Technology Choices

	Candidate A: {Design-X, Function-Y}	Candidate B: {Design Z, Design F}
Reliability 99%- 99.9%	50%	100%
Performance 11sec.- 1 sec.	80%	30%
Usability 30 min.- 30 sec.	-10%	20%
Capital Cost 1 mill.	20%	5%
Engineering Hours 10,000	2%	10%
<i>Performance/Capita l Cost Ratio</i>	$80/20= 4.0$	$30/5= 6.0$
<b><u>Quality/Cost Ratio</u></b>	$120/22=5.46$	$150/15=10.00$

# Example 3D Color Graph Impact Estimation



# Evo : Evolutionary Project Management

- *Early and frequent feedback*
- *On complex systems (your organization, your project, your product development)*

# Evo Cycles Map

Project Architecture and Management Level

Requirements and Architecture

"Head"

Plan/Study/Act

A Step

"Body" or "micro-project"



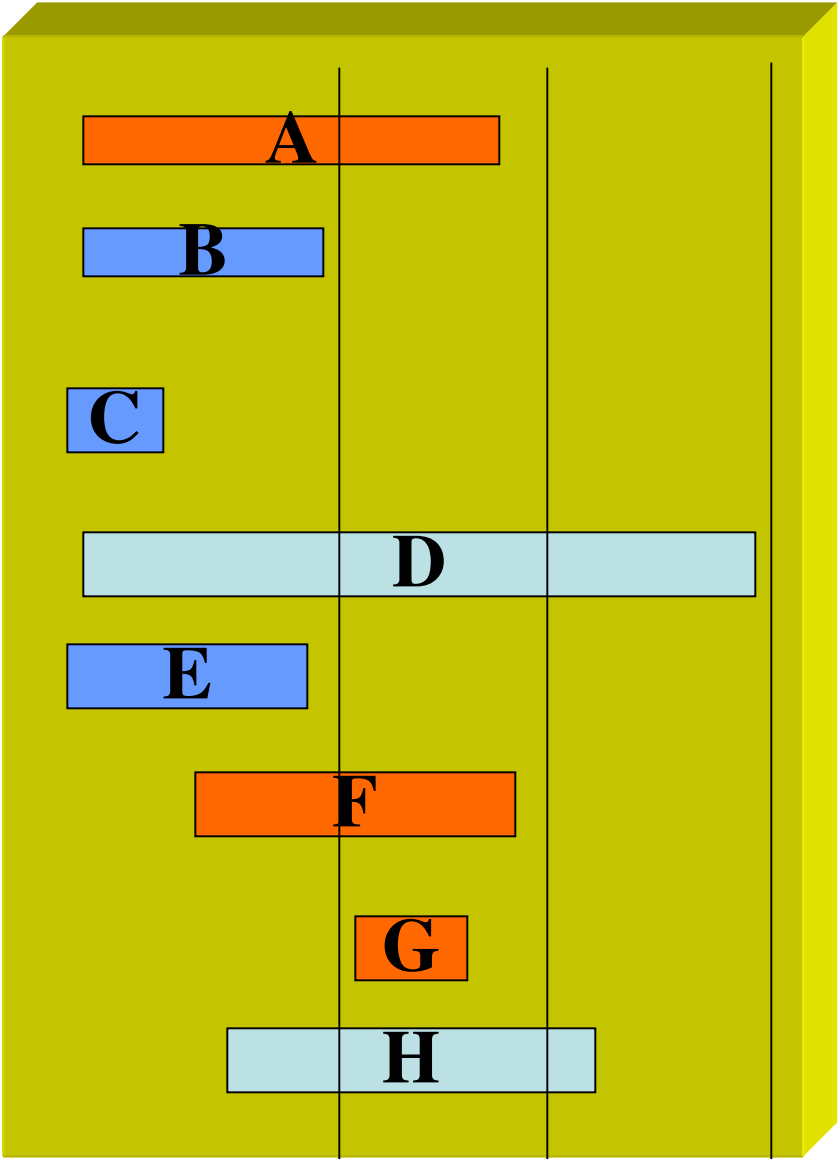
- Set Improvement Targets
- Find Design ideas/Strategies
- Evaluate Ideas
- Make Calendar-time plan
- Make or Buy the Evo step
- System Test Step internally
- Do Step with User
- Study Results

PLAN

Do

Study

# Backroom



August 1, 2002

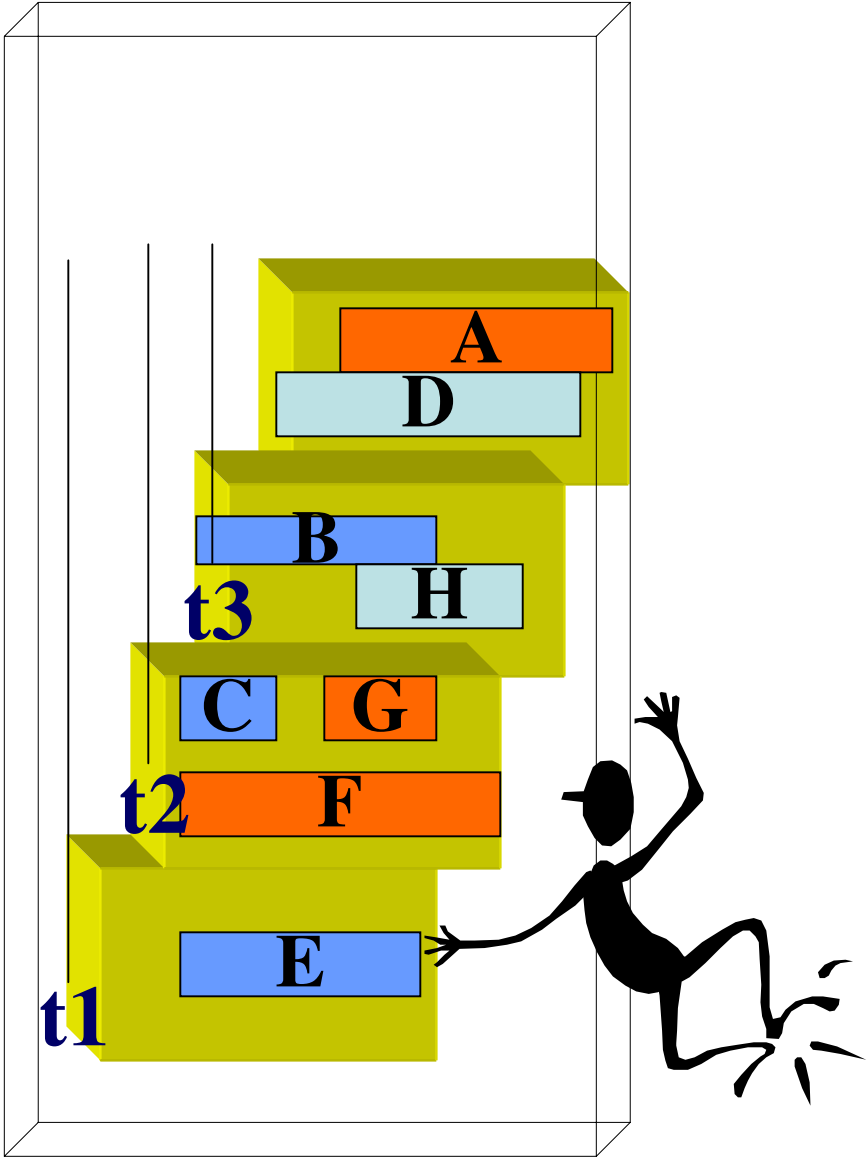
$t_1$

$t_2$

$t_3$

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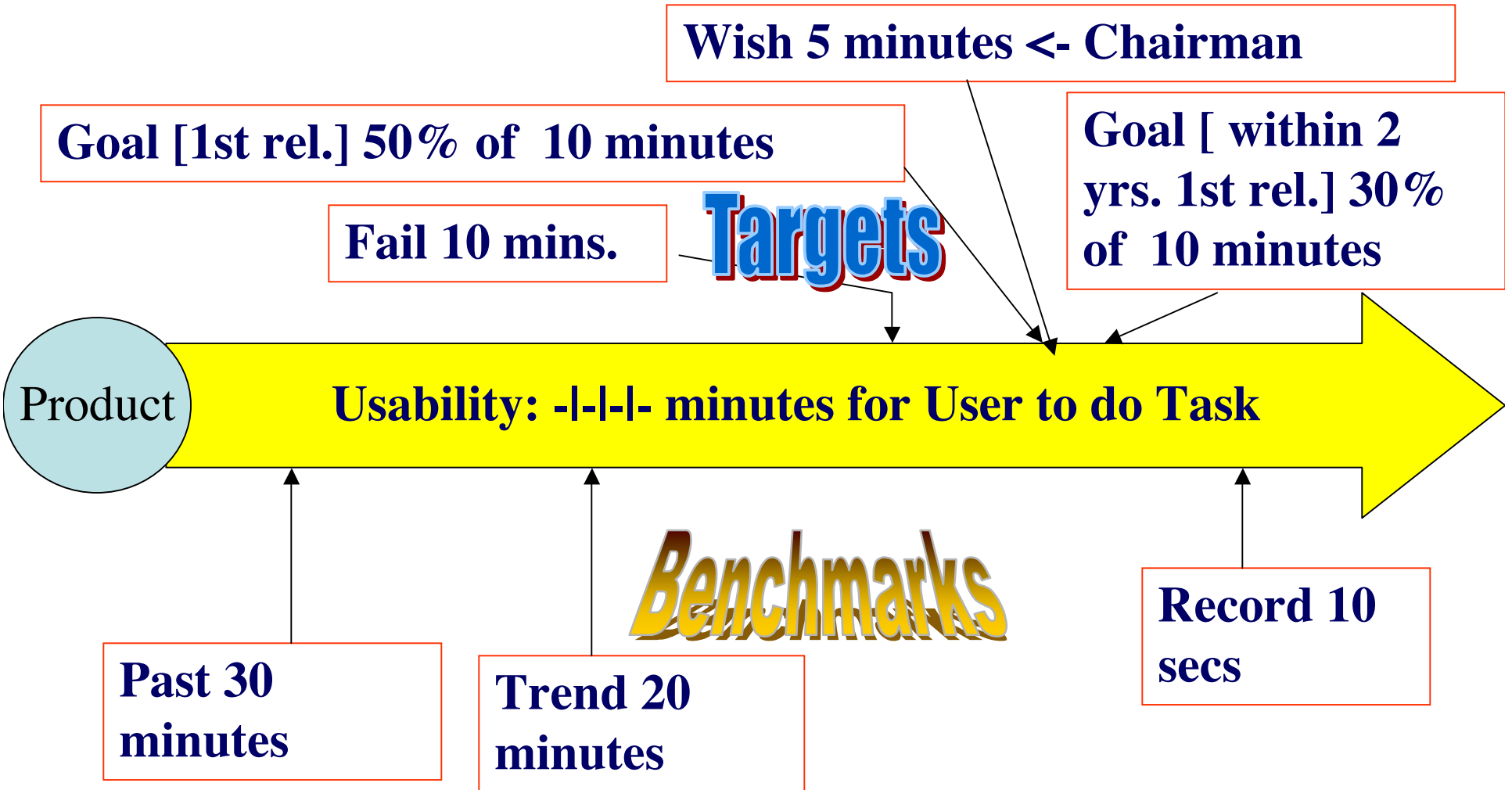
# Frontroom



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Slide 39

# Usability Example Graphically



# Usability Evo Delivery

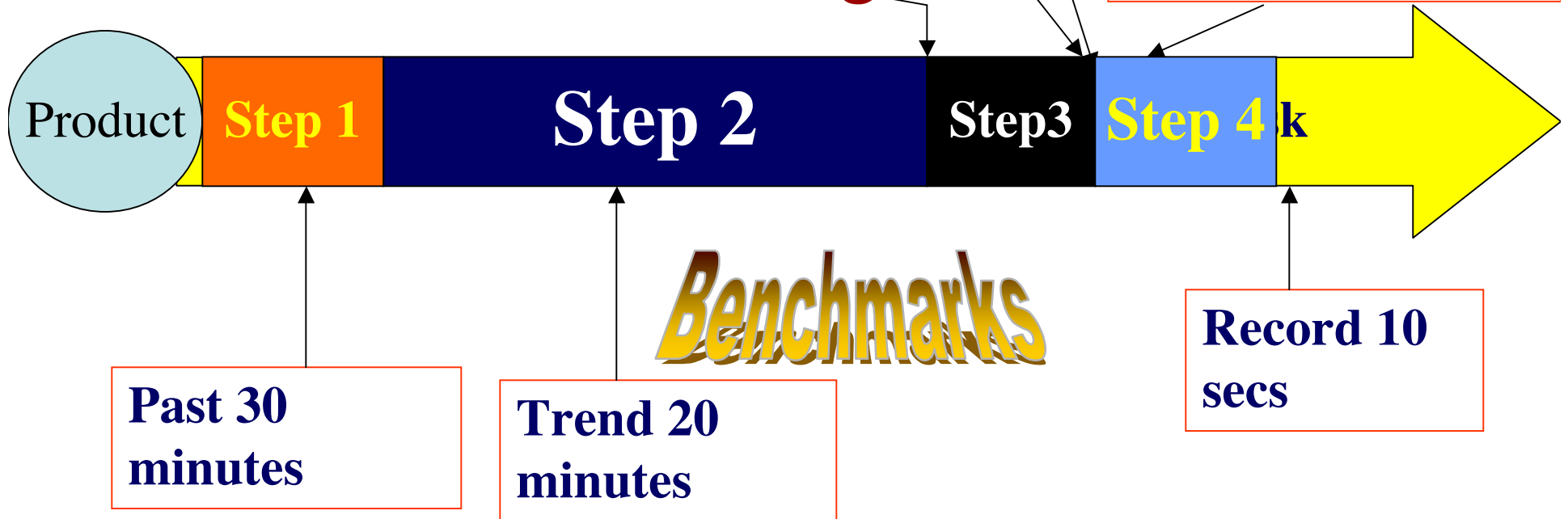
Wish 5 minutes <- Chairman

Plan [1st rel.] 50% of 10 minutes

Plan [ within 2 yrs.  
1st rel.] 30% of 10  
minutes

Must 10 mins.

**Targets**



# Impact Table for Step Management

	Step #1 A: {Design -X, Function-Y}	Actual	Difference. - is bad + is good	Total	Step #2 B: {Design Z, Design F}	Actual	Difference	Total	Step #3 Next step plan
Reliability 99%- 99.9%	50% ±50%	40%	-10%	40%	100% ±20%	80%	-20%	120%	0%
Performance 11sec.- 1 sec.	80% ±40%	40%	-40	40	30% ±50%	30%	0	70%	30%
30 min. -30 sec.	10% ±20%	12%	+2%	12%	20% ±15%	5%	-15%	17%	83%
Capital Cost 1 mill.	20% ±1%	10%	+10%	10%	5% ±2%	10%	-5%	20%	5%
Engineering Hours 10,000	2% ±1%	4%	-2%	4%	10% ±2.5%	3%	+7%	7%	5%
Calendar Time	1 week	2 weeks	-1week	2 weeks	1 week	0.5 weeks	+0.5 wk	2.5 weeks	1 week

# Microsoft

## SECRETS

How the World's Most Powerful Software Company

Creates Technology,

Shapes Markets,

and Manages People

Michael A. Cusumano

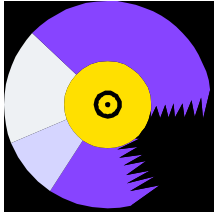
Richard W. Selby

*Microsoft*

**Very detailed independent account of Microsoft's software development process.**

**Several levels of Evolutionary delivery.**

**Much other detail of interest to software managers**



# Multiple Levels of Microsoft Evo

Office 2001 Level

Shippable  
Quality level

Milestones



6->10 Weeks

6->10 Weeks



Priority Determination (Practical detail) 12:32pm  
NON CONFIDENTIAL VERSION OF REAL  
CASE 18 APRIL 2002 UK

- Basis: Value/Cost for Stakeholders
- Method: specify these things for each component in Planguage
- Practical:
  - Develop template for this for components
  - Do one for real for a real component
  - Develop Rules for doing this
  - Develop Policy for doing this

## Template for Priority Information Components 14:02 Version of Template

- **Component Name:**
- **Spec Version:**
- **Component Version:**
- **Description:**
- **Owner:**
- **Quality level:**
- **Implementer:**
- **Stakeholders:**
- **Initial Use**
- **Sponsor:**
- **Value [Component]: 1 to 10 scale and underlying info**
  - **Real Customer [??who]:**
  - **TXX**
  - **WXXX**
  - **Longer term market**
  - **Short term Credibility**
  - **More Mileage:**
- **Costs [Component]**
  - **Build Costs [Remaining]:**
  - **Install Costs [One site]**
  - **Maintenance Costs:**
- **Competitive Components are:**
- **Proposed Delivery Date:**
- **Risks:**
- **Dependencies:**
- **Issues:**
- **Constraints:**

## Template for Priority Information Components: 12:42 exercise

- **Component Name: Insurance Officer [Version 1.2]**
- **Spec Version: Thursday, April 18, 2002 12:42**
- **Quality level [April 2002]:**
- **Owner: WXXX & TXX**
- **Implementer [Cxx]: Mark?**
- **Stakeholders: {Cxx, TXX [Hassan] “On contract list”, Aurora, Axa, WXXX, ...}**
- **Initial Use: Demo to build interest and credibility at Cxx and TXX**
- **Sponsor: Jxxx Azari at Cxx**
- **Value [Component]: 0 to 10 scale and underlying info: 2 ? Consensus <- Demo NPS**
  - **Real Customer [Cxx]: 0**
  - **TXX: 7**
  - **WXXX: 7**
  - **Longer term market: 7**
  - **Short term Credibility: 3->8?**
- **Costs [Component]: Primarily in terms of weeks to successfully implement**
  - **Build Costs [Remaining weeks to Demo Install ready]: 8 weeks ±4 weeks**
  - **Install Costs [One site] 1 week**
  - **Maintenance Costs: 1 day /week effort from WXXX (demo) <- questions about it**
- **Competitive Components are: {Account Manager <-Andy, Internal Quotation Service <- Jane, Direct Debit [already shipped] <-Chris, Product Manager}.**
- **Proposed Delivery Date: April 30th [On current schedule!] +2 weeks ????**
-

# Template for Priority Information Components: 13:10

**Component Name:** Product Manager

**Spec Version:** 4/18/02 1:13 PM

**Component Version:** 1.2

**Description:** Demo 'Product Manager and bring out (slides?) how it impacts Tiering and NOT YET Bundling without INTERNAL QUOTATION?

**Owner:** WXXX

**Quality level:** Out of Date (needs updating) <- Jane, Demonstration level, Not Operational level [Not tested enough to know]

**Implementer:**

**Stakeholders:** {Cxx, Alan BI.Vision (see below), XXXX (Credibility), IAS, }

Note: AB Vision supported is: **"The system will support  
"tiered and bundled" Assist products and  
enable Cxx to launch one new product per quarter."**

**Initial Use:** Demo

**Sponsor:** Jxxx [would officially support getting the demo in place]/Alan? [would condescend to see the demo]

Rationale: to help Cxx understand and clarify what 'Tiering and Bundling are [Alan Bxxxx Vision]"

**Value [Component]:** 1 to 10 scale and underlying info: General Rating 3 <-Jane (no Internal Quotation), 9<-JC

Real Customer [Cxx, Demo]: 7 <-JC Rationale: learning process as noted in Rational/Sponsor

TXX: 5 (if it visibly improves Cxx opinion of TXX)

WXXX 9 (if it shows we are on top of responding to CXPP Alan Bxxxx requirements, Tiering etc.)

Longer term market: 7<-JC Rationale: (possible demo & reference for others, even in short term)

Short term Credibility: 5 , Rationale: connects to A Bxxxx's vision clearly

More Mileage: 9 <-Chris. Rationale: increases the interest in ANY demos we do, helps us talk them through the new products. Talking their language straight away.  
It could be the start of a development sequence. <-Chris

**Costs [Component= PM, Demo as described here, adding Tiering and NOT Bundling] ]**

Build Costs [Remaining]: 6 calendar weeks ± 3 weeks (4 to do, 2 to test <-Andy)

Install Costs [One site = Cxx, Successful Demo] 1 week

Maintenance Costs: 1day a week of effort

**Competitive Components (for earlyt delivery and resources) are:** Internal Quotation might be quicker? <- Jane.

**CONCLUSION:** we must find something much shorter ( 1 week or so): this timing is total time to closedown! <-Tom Gilb

**Proposed Delivery Date:**

**Risks:**

Shows that product setup is different from Polaris <-Jane, Raises expectations prematurely to real usage.

We fail to do even this by closedown (3 months hence) and there are not more 'chances ' to demo credibility. <-TG

**Dependencies:**

D1: Matt {is not distracted [Rules integration?, is available, is given support in requirements & design], AND ??

D2: data model needs to be finalised

**Issues:**

1. We do not have a TXXhtly defined idea of what we should be doing[Int/Bund] <-Jane

2. We do not know the underlying dependencies from WXXX related areas like Rules integration

**Constraints:**

C1: only two people are domain expert and worked on the original one (Fen, Matt)

C2

# Policy for Priority Determination

- 1. We will document all potential delivery step candidates using the Priority Template before making decisions as to our delivery sequence

# Last Slide

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