Innovation in Service Delivery
TRIZ in IT & Retails

Friday 01 November 2013 6:30pm – 8pm
CF401 PolyU

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Six Sigma Society

香港創新學會
Institute of Systematic Innovation, HK

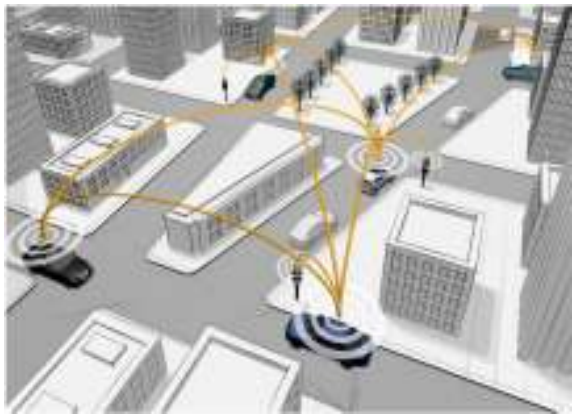
Table of Content

My Background

Scope of business

Digital textile printing

Internet mining
& tracking research



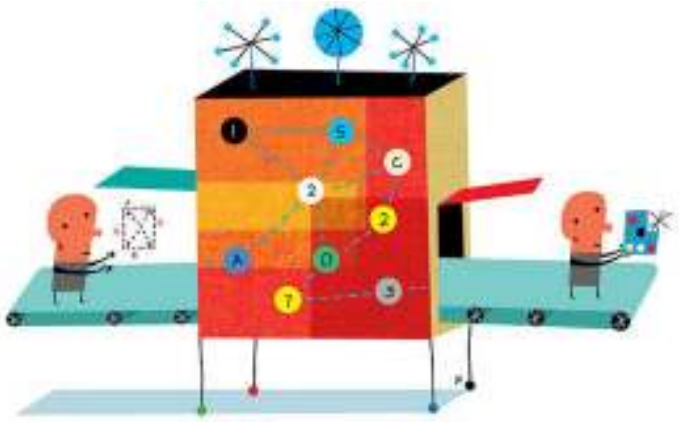
Mobile Retailing

Innovation Types

Transaction innovation

马云
马化腾
- Jockey Club as Bank ?
- HK Ex as game center ?

Product innovation



Process innovation

My status quo

G. S. Altshuller

- Genrich Saulovich Altshuller (1926-1998).
- 1946 was working in Soviet Navy patent office.
- 1948 wrote a letter to Comrade Stalin wishing to help the motherland do better invention.
- 1950 arrested for “investor’s sabotage” sent to the Gulag.
- 1956 wrote his first paper.

What is TRIZ

TRIZ

- *Teoriya Resheniya Izobreatatelskikh Zadatch*
- (Russian) Theory of inventive problem solving.
- Started with Altshuller's interest in invention and work in Soviet Navy patent office. Systematic, Structured Way of Thinking
- Science
- Results of Over 50 Years Research Analyzing Over Two Million Worldwide Patents within All Engineering Disciplines

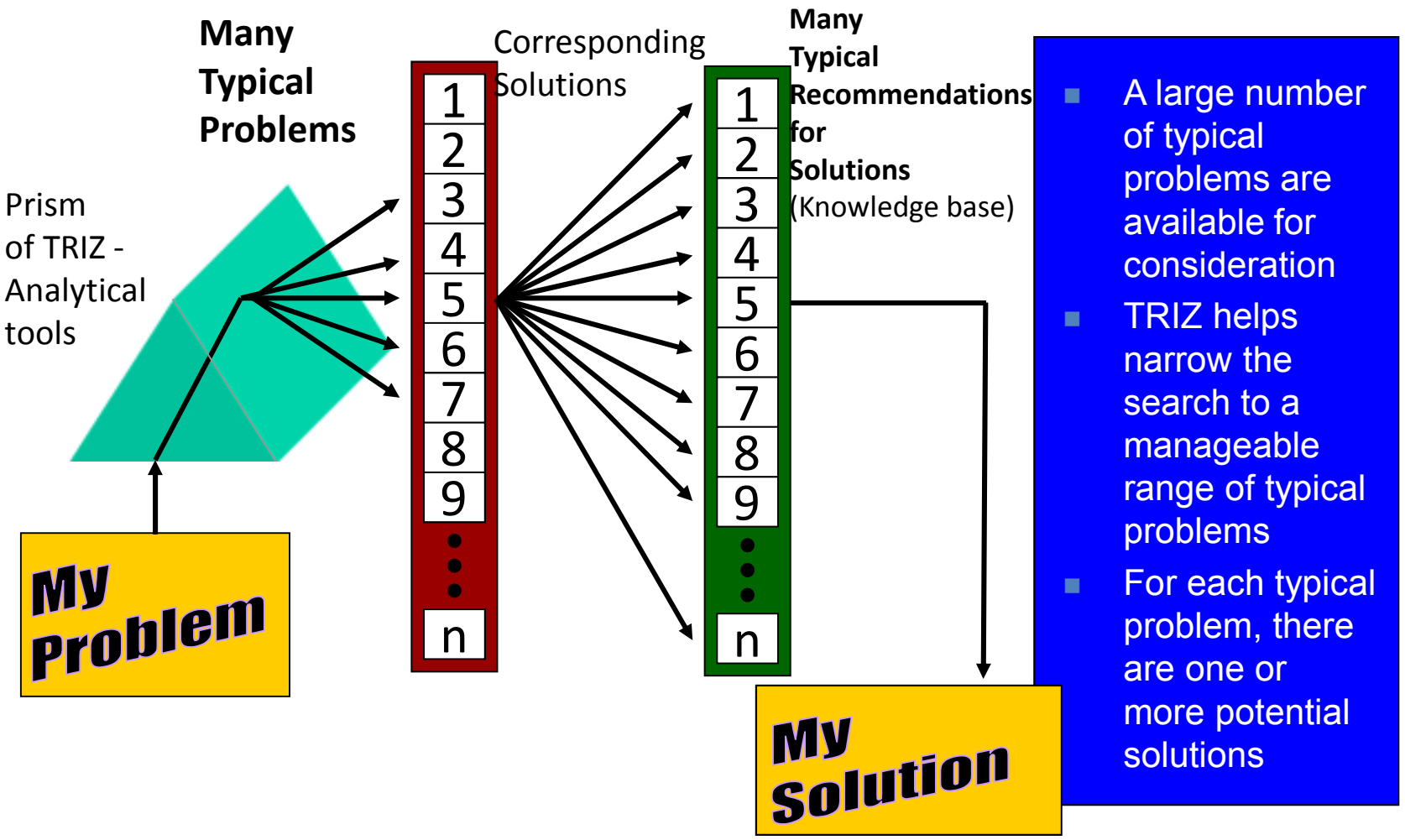
What is TRIZ

- TRIZ is an evolving, open-ended system for enhancing human inventiveness through
  - Systematic identification of problems and ideal solutions
  - Overcoming various blocks through heuristics and approaches that have worked in other disciplines

What is TRIZ

THINKING ANALOGICALLY (WITHOUT AN EGO)

What is TRIZ



- A large number of typical problems are available for consideration
- TRIZ helps narrow the search to a manageable range of typical problems
- For each typical problem, there are one or more potential solutions

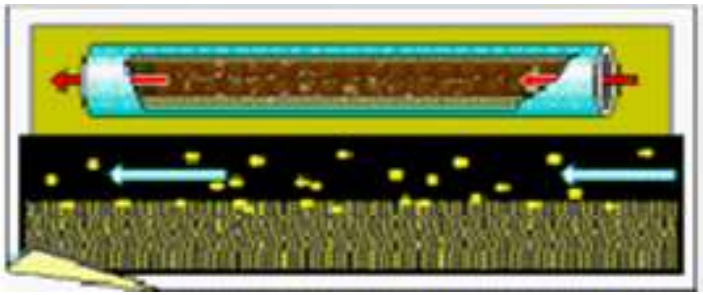
What is TRIZ

Ideas Transition

Given system

Filter cleaning

A filter used to treat fine-grained sand consists of a tube whose walls are coated with a porous, felt-like material. When air passes through the tube, the sand particles are trapped in the pores



Problem: Cleaning such a filter is difficult

Idea: Use slow increase of the pressure inside the chamber followed by abrupt pressure drop.

System - analog

Sweet pepper canning method

Before sweet peppers can be canned, the stalk and seeds must be separated from the pod.

Problem: This was done manually in the past – automation was difficult to implement because the pods are non-uniform in shape and size.

Idea: In a modern canning method, the peppers are placed in an air-tight container, in which pressure is gradually increased to 8 atm; the pods shrink, resulting in fracturing at the weakest point, where the pod bottom joins the stalk. Compressed air penetrates the peppers at the fractures, and the pressure inside and outside the peppers equalizes. The pressure in the container is then quickly reduced; the pod bursts at its weakest point (which has been further weakened by fractures) and the pod bottom is ejected, taking the seeds with it.

Patterns of Invention

- Altshuller recognized that the same fundamental problem (contradiction) had been addressed by a number of inventions in different areas of technology
- He also observed that the same fundamental solutions were used over and over again, often separated by many years
- He reasoned that if the latter inventor had known of the earlier solution, his/her task would have been straightforward
- He sought to extract, compile, and organize this information

What is TRIZ

TRIZ Basic Foundational Principles

- Ideality = $\frac{\Sigma \text{ Functionality}}{\Sigma \text{ Costs} + \Sigma \text{ Harm}}$

(useful functions F_U, harmful functions F_H)

- Contradictions

- Maximal use of resources

Function Analysis

Component Analysis

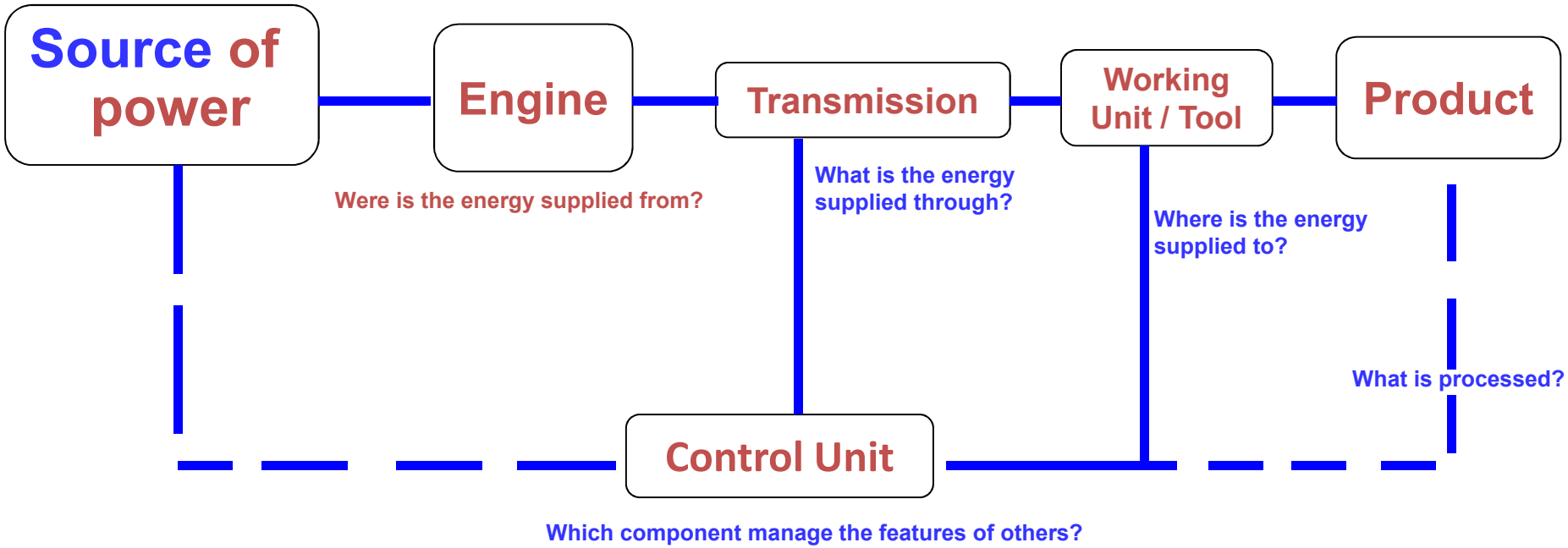
Interaction Analysis

Function Modeling

What is TRIZ

What are the basic technical system components?

System completeness: the minimal composition of a viable and operable technical system that presents and performs minimal working efficiency.

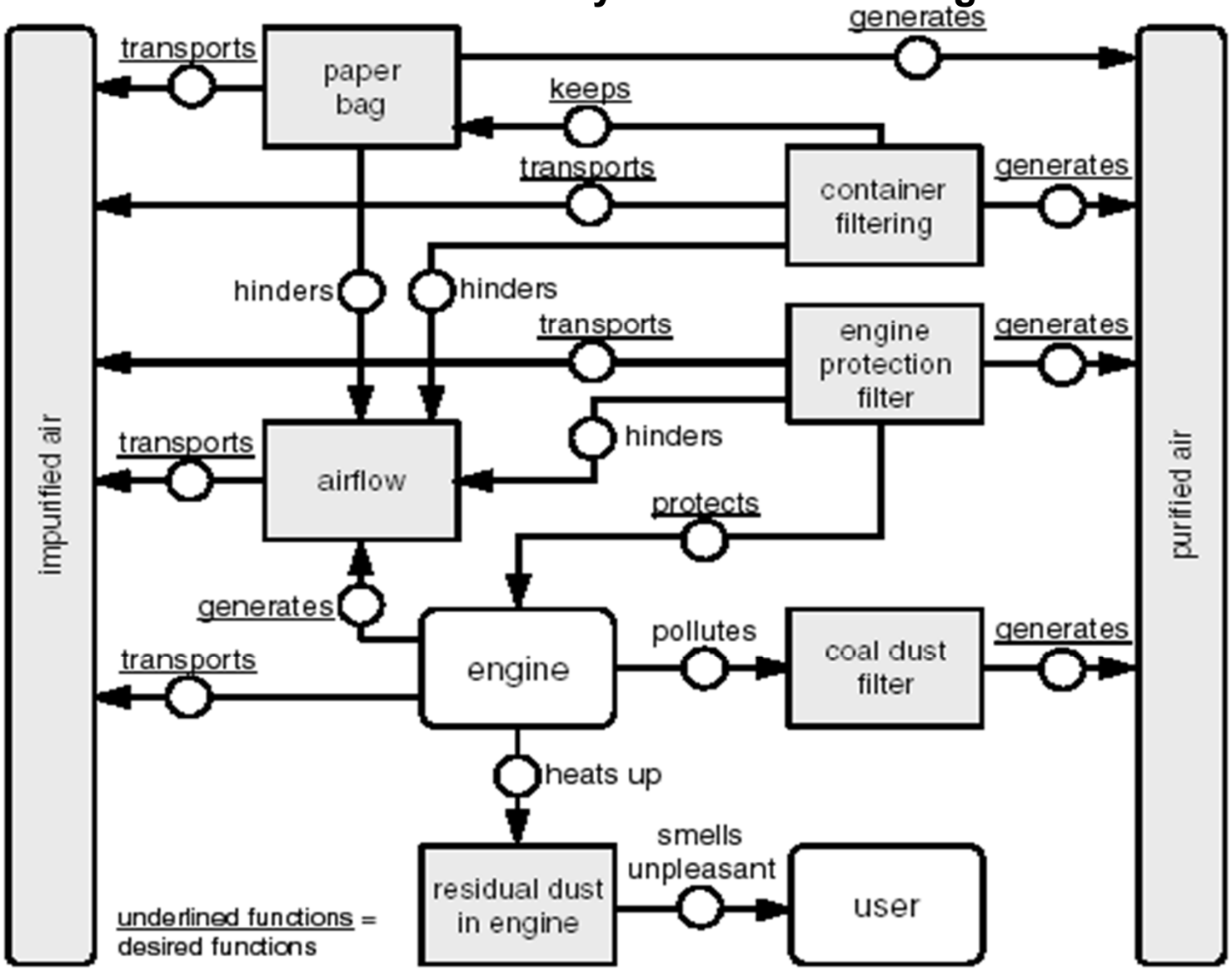


TRIZ is good at Control Systems issues, such as applicator, robots, surveillance and motion detection, ASIC computers, sensors, telecommunication and kernel levels programming. Application could be iOS battery consumption routine. Business Application, Can attempt to integrate with Soft System Methods (from U. of Lancaster) and EA

What is TRIZ

Component and Functional Analysis Example

Function model for the filter system of an existing vacuum cleaner



Contradictions

- Every system consists conflicts, in TRIZ they are called: contradictions. For example weight vs. strength, speed vs. precision. An inventive solution satisfies **both** requirements.

- The contradiction occurs when we are trying to improve one parameter or characteristic of a technique (a technical system - TS or/and a technological process -TP) and then the same or other characteristics or parameters of the technique are affected negatively.

Subway Auto Fare Collection

Contradiction

High speed transmission versus security & resilience

Tailgating versus recognition time

What is TRIZ

Technical Contradictions & the Matrix

- Parameter A improves, but parameter B deteriorates, strength v. weight.
  - Usually involves tradeoff or compromise
  - TRIZ seeks to surmount contradiction.
- In patent study, Altshuler identified 39 engineering parameters and 40 inventive principles
- 39 x 39 matrix of parameter contradictions

Altshuller's Parameters

1. Weight of moving object
2. Weight of nonmoving object
3. Length of moving object
4. Length of nonmoving object
5. Area of moving object
6. Area of nonmoving object
7. Volume of moving object
8. Volume of nonmoving object
9. Speed
10. Force
11. Tension, pressure
12. Shape
13. Stability of object
14. Strength
15. Durability of moving object
16. Durability of nonmoving object
17. Temperature
18. Brightness
19. .Energy spent by moving object
20. Energy spent by nonmoving object

More Parameters

21. Power
22. Waste of energy
23. Waste of substance
24. Loss of information
25. Waste of time
26. Amount of substance
27. Reliability
28. Accuracy of measurement
29. Accuracy of manufacturing
30. Harmful factors acting on object
31. Harmful side effects
32. Manufacturability
33. Convenience of use
34. Repairability
35. Adaptability
36. Complexity of device
37. Complexity of control
38. Level of automation
39. Productivity

Technical Contradiction

- Weight of moving object vs force
- Use 8, 10, 18, 37
  - Counterweight
  - Prior action
  - Mechanical vibration
  - Thermal expansion
- Amounts to an expert system depending upon technical blocks.

What is TRIZ

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Weight of moving object	Weight of stationary object	Length of moving object	Length of stationary object	Area of moving object	Area of stationary object	Volume of moving object	Volume of stationary object	Speed	Force (intensity)	Stress or pressure	Shape	Stability of the obje compos		
1	Weight of moving object	+		15, 8, 29,34		29, 17, 38, 34		29, 2, 40, 28		2, 8, 15, 38	8, 10, 18, 37	10, 36, 37, 40	10, 14, 35, 40	1, 35, 19, 39	28, 27, 18, 40	5, 3 31,
2	Weight of stationary object		+		10, 1, 29, 35		35, 30, 13, 2		5, 35, 14, 2		8, 10, 19, 35	13, 29, 10, 18	13, 10, 29, 14	26, 39, 1, 40	28, 2, 10, 27	
3	Length of moving object	8, 15, 29, 34		+		15, 17, 4		7, 17, 4, 35		13, 4, 8	17, 10, 4	1, 8, 35	1, 8, 10, 29	1, 8, 15, 34	8, 35, 29, 34	19
4	Length of stationary object		35, 28, 40, 29		+		17, 7, 10, 40		35, 8, 2,14		28, 10	1, 14, 35	13, 14, 15, 7	39, 37, 35	15, 14, 28, 26	
5	Area of moving object	2, 17, 29, 4		14, 15, 18, 4		+		7, 14, 17, 4		29, 30, 4, 34	19, 30, 35, 2	10, 15, 36, 28	5, 34, 29, 4	11, 2, 13, 39	3, 15, 40, 14	6,
6	Area of stationary object		30, 2, 14, 18		26, 7, 9, 39		+				1, 18, 35, 36	10, 15, 36, 37		2, 38	40	
7	Volume of moving object	2, 26, 29, 40		1, 7, 4, 35		1, 7, 4, 17		+		29, 4, 38, 34	15, 35, 36, 37	6, 35, 36, 37	1, 15, 29, 4	28, 10, 1, 39	9, 14, 15, 7	6, 35
8	Volume of stationary object		35, 10, 19, 14	19, 14	35, 8, 2, 14				+		2, 18, 37	24, 35	7, 2, 35	34, 28, 35, 40	9, 14, 17, 15	
9	Speed	2, 28, 13, 38		13, 14, 8		29, 30, 34		7, 29, 34		+	13, 28, 15, 19	6, 18, 38, 40	35, 15, 18, 34	28, 33, 1, 18	8, 3, 26, 14	3, 1 35,

TRIZ – 40 Principles

1 Segmentation
2 Taking out
3 Local quality
4 Asymmetry
5 Merging
6 Universality
7 Russian dolls
8 Anti-weight
9 Preliminary anti-action
10 Preliminary action
11 Beforehand cushioning
12 Equipotentiality
13 "The other way round"
14 Spheroidality - Curvature
15 Dynamics
16 Partial or excessive actions
17 Another dimension
18 Mechanical vibration
19 Periodic action
20 Continuity of useful action
21 Skipping
22 Blessing in disguise
23 Feedback
24 Intermediary
25 Self-service
26 Copying
27 Cheap short-lived objects
28 Mechanics substitution
29 Pneumatics and hydraulics
30 Flexible shells and thin films
31 Porous materials
32 Colour changes
33 Homogeneity
34 Discarding and recovering
35 Parameter changes
36 Phase transitions
37 Thermal expansion
38 Strong oxidants
39 Inert atmosphere
40 Composite materials

Physical Contradiction

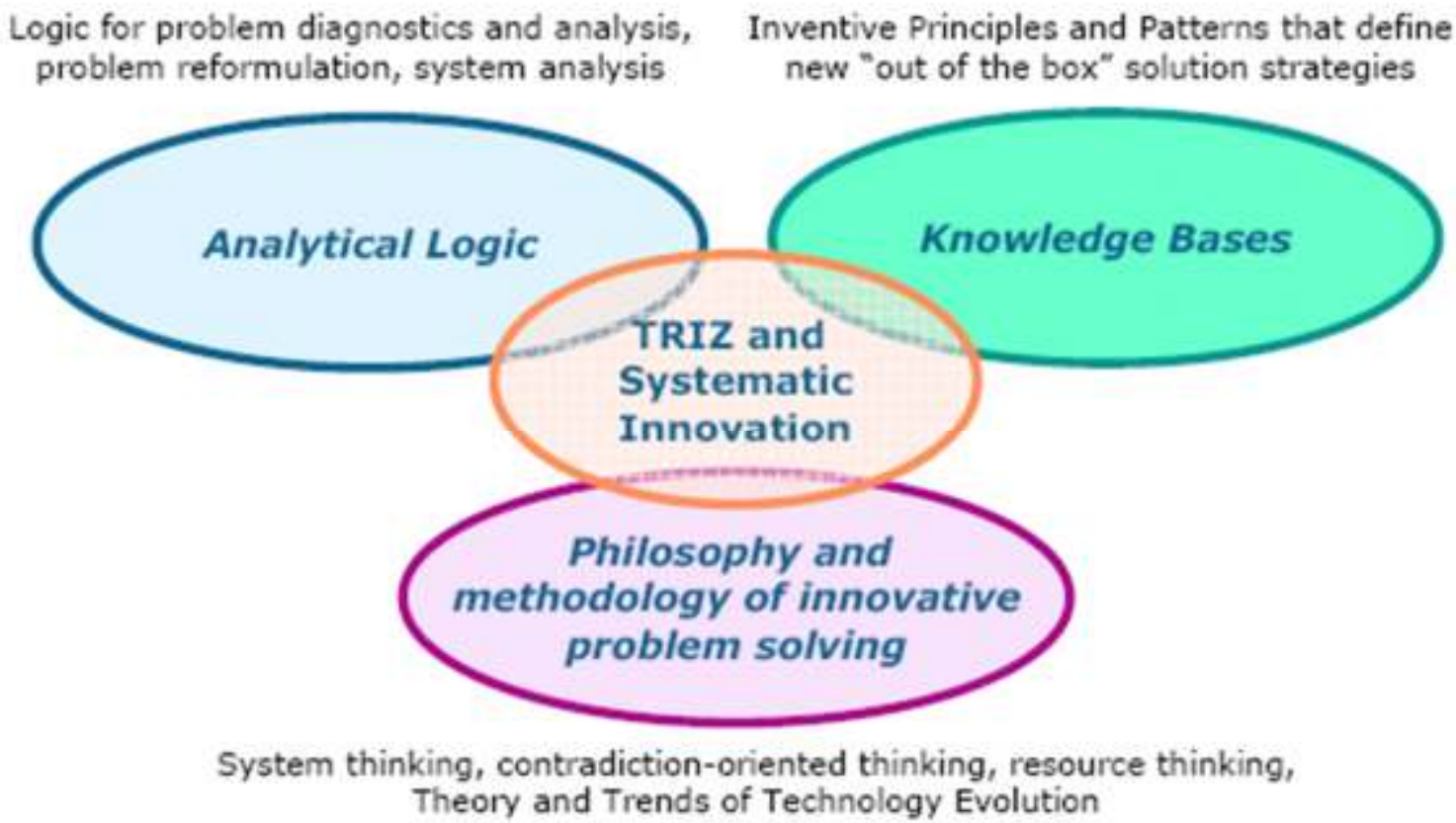
- Single parameter that we want to both increase and decrease.
- Do not compromise: Invent.
- Separation principles for overcoming:
  - Separation in time
  - Separation in space
  - Separation in scale

Examples of Separation Solutions for Physical contradiction

- Siberian pile driving: desire sharp point to drive easily, blunt point to sustain max load.
  - Separate in time
  - Explosive charge after driving
- Coating problem: high temp for quick coating, but coating breaks down
  - Separate in space
  - Local heating, quick coating, but chemical OK.

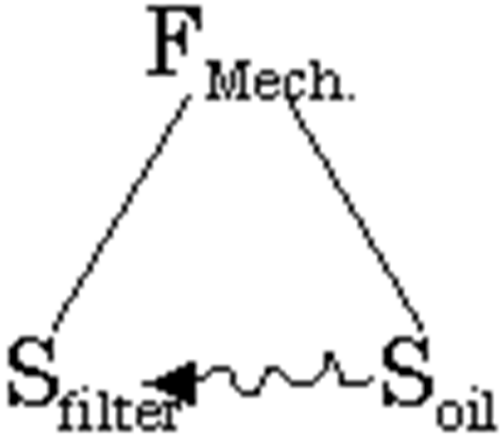
What is TRIZ

Modern TRIZ



SU-Field Theory

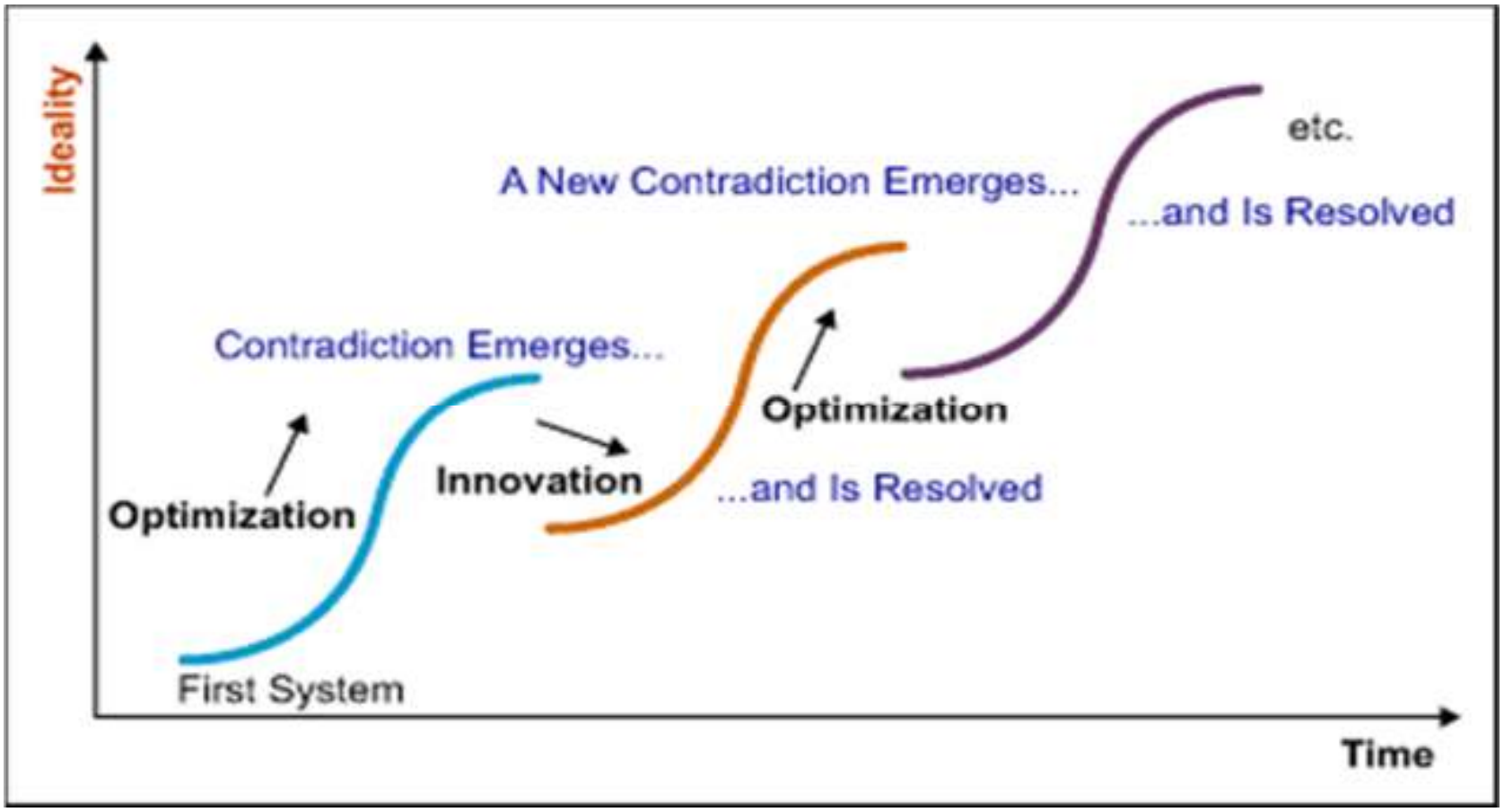
- Substances act through fields
- Field types:
  - Mechanical
  - Acoustic
  - Thermal
  - Chemical
  - Electric
  - Magnetic
- Diagram



What is TRIZ

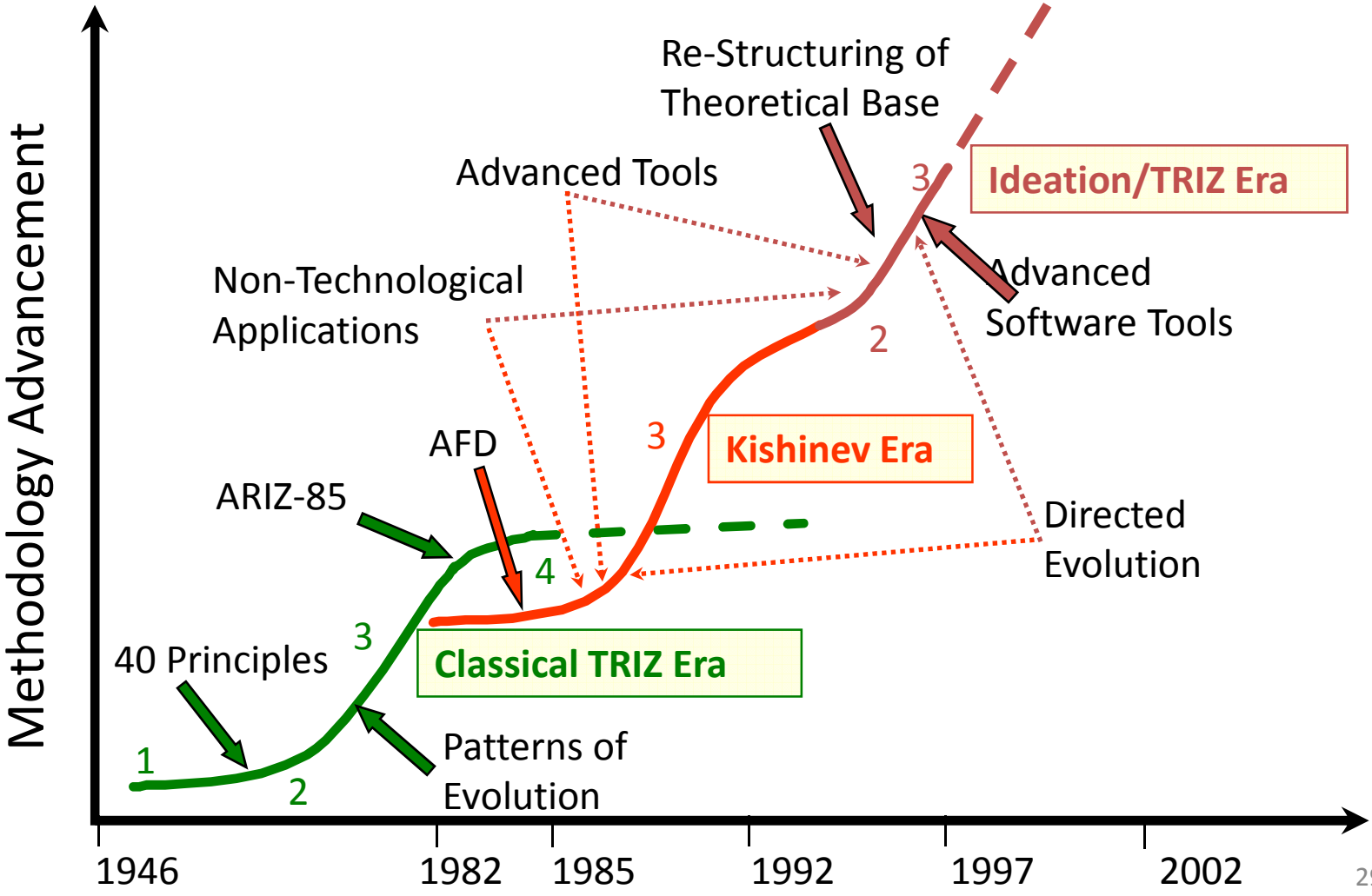
The Driving Forces of Technological Evolution

Ideality, Innovation, Consumers, Resources



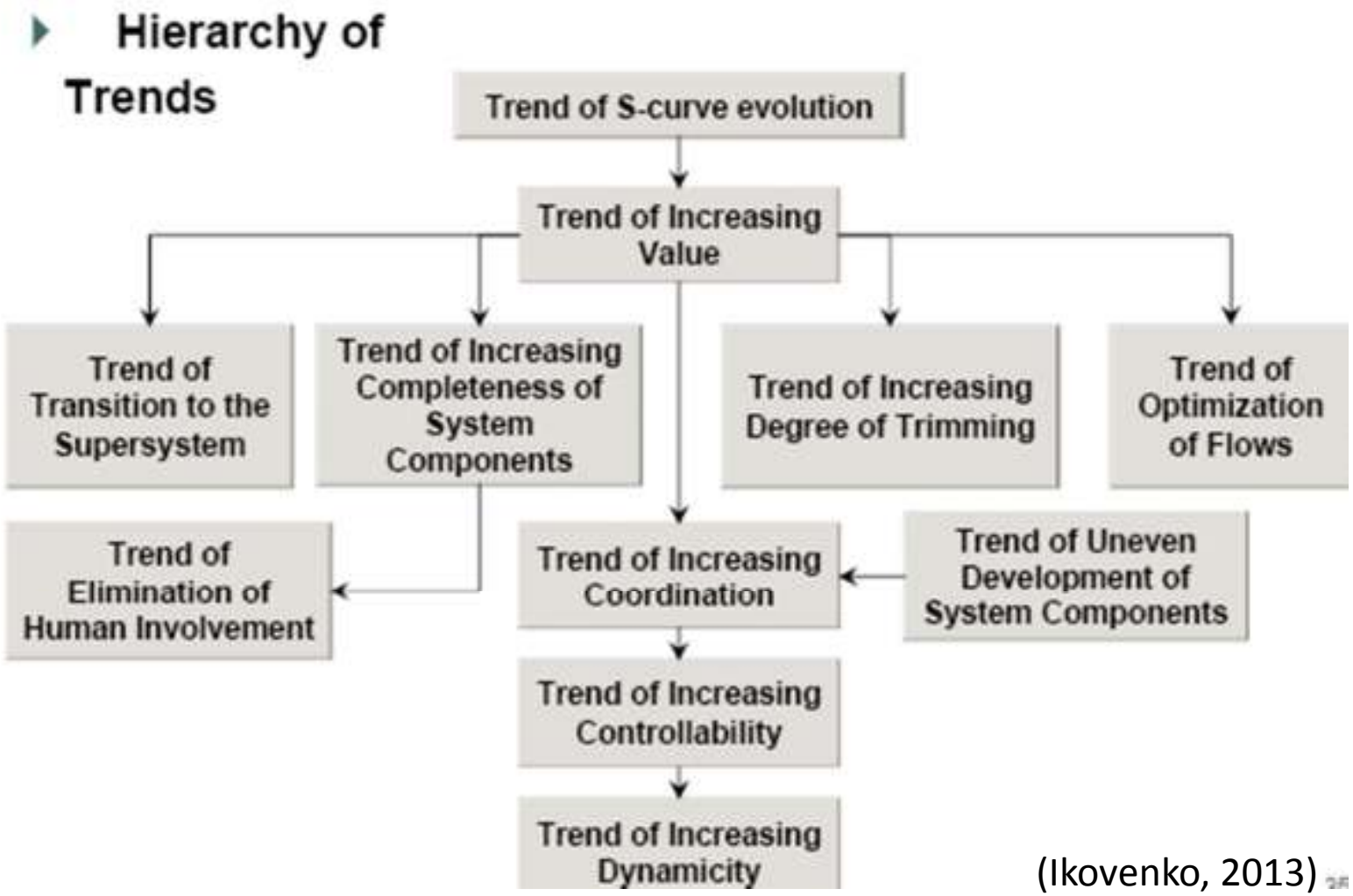
What is TRIZ

Evolution of the TRIZ Methodology



What is TRIZ

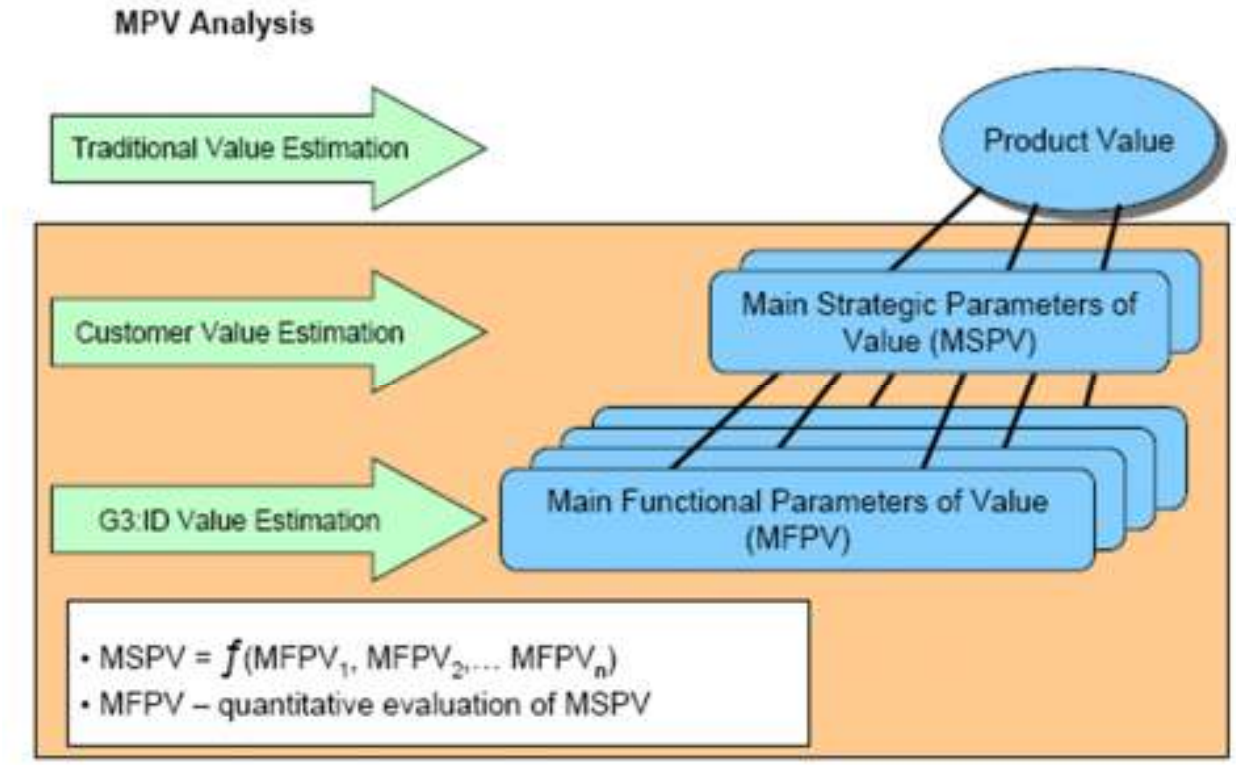
Modern TRIZ

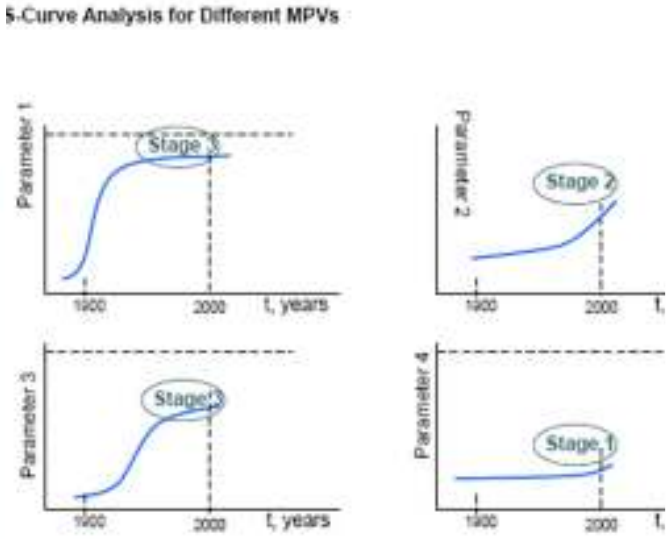


(Ikovenko, 2013)

What is TRIZ

Modern TRIZ

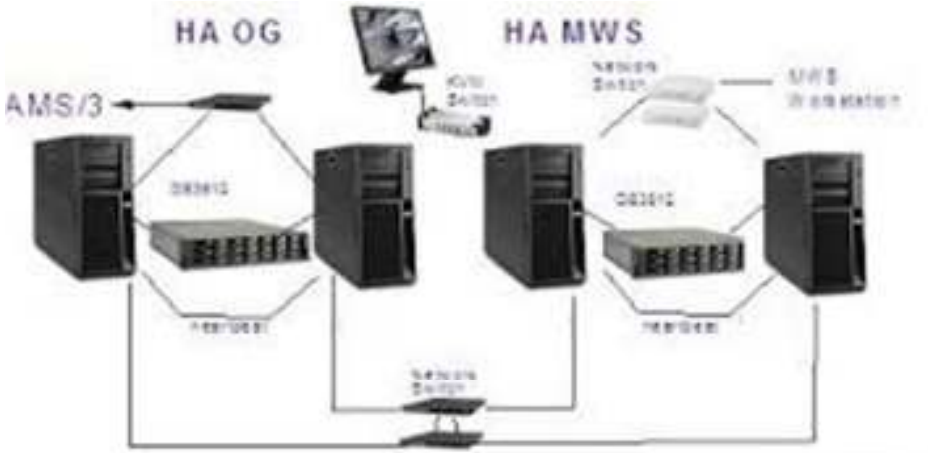




(Ikovenko, 2013)

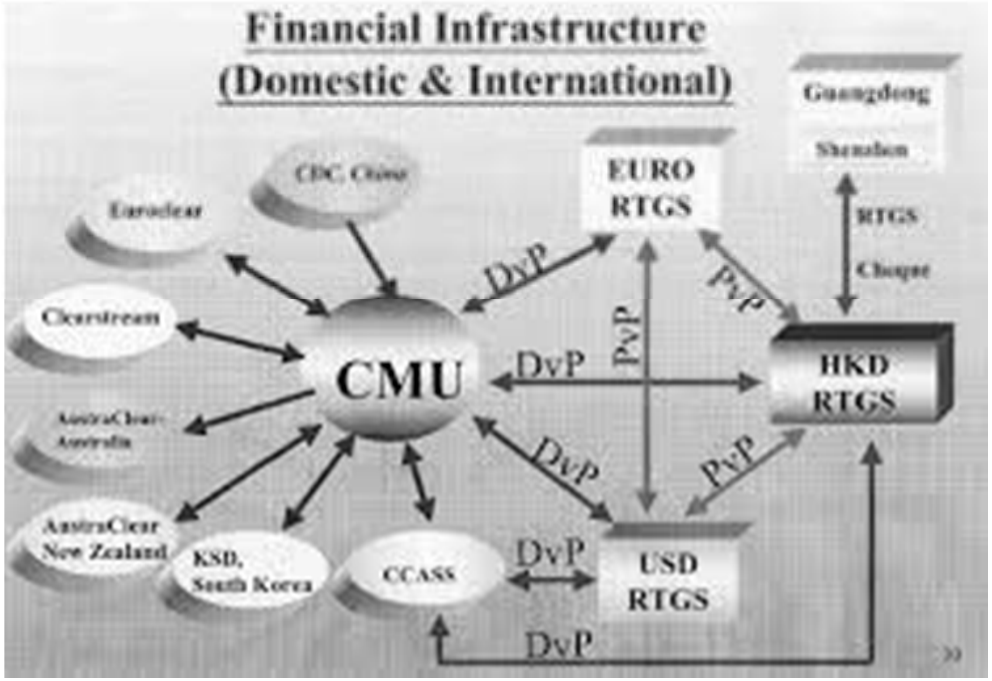
A Siemen BU in Zug, Switzerland is doing MPV and S-curve analyses on their global SAP system for E-Commerce.

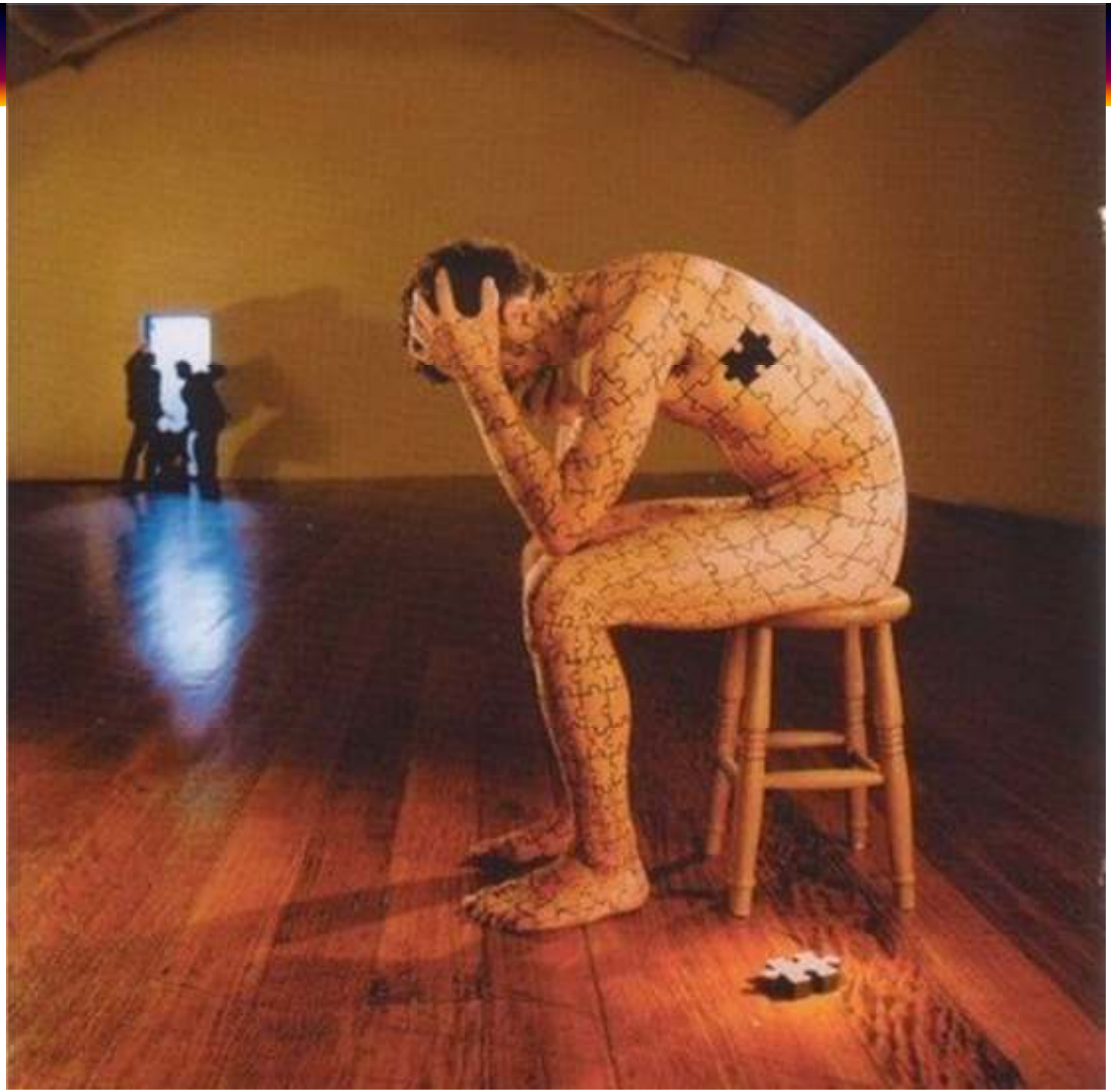
What is TRIZ



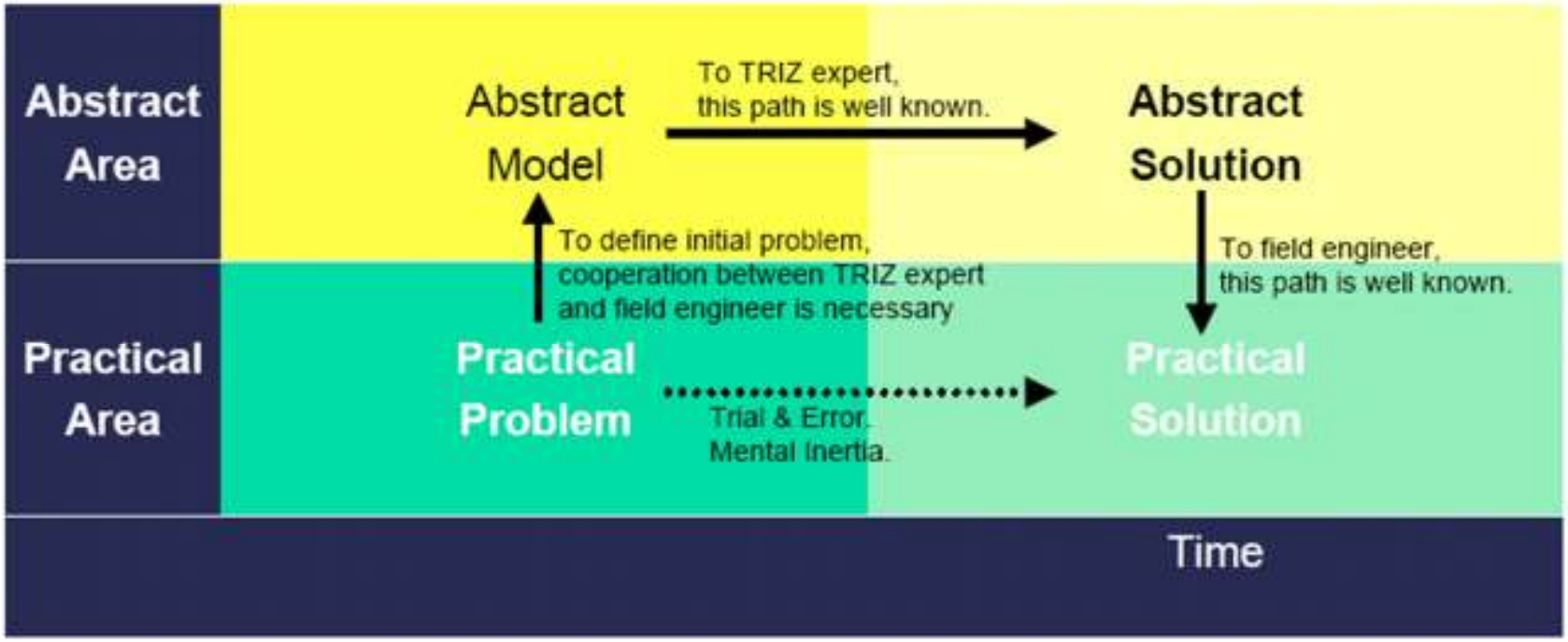
Any contradiction in trade book orders? Within the second-based auction duration?

Any contradiction in international swift clearance? Including physical exchanges?





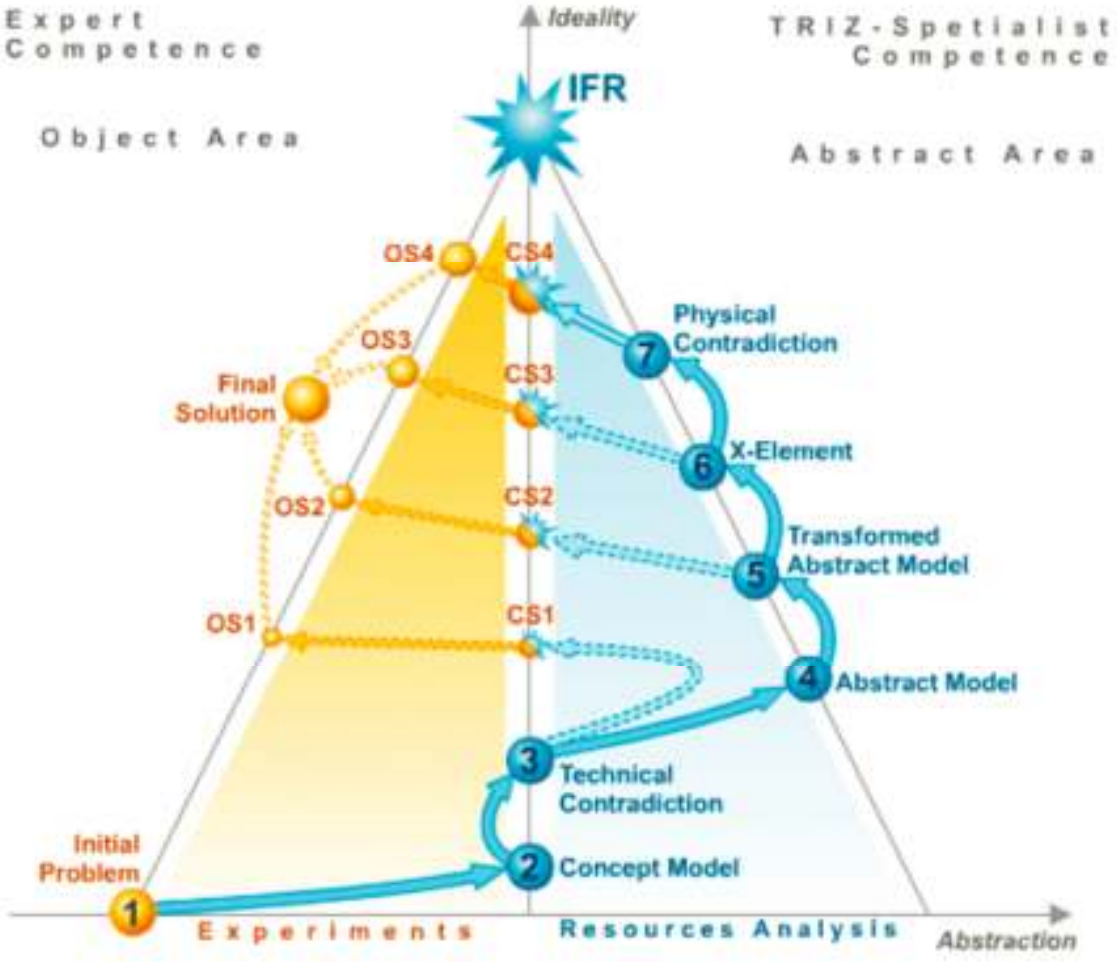
Samsung Experience (2004)



*from Nikolai Khomenko

Samsung Experience (2004)

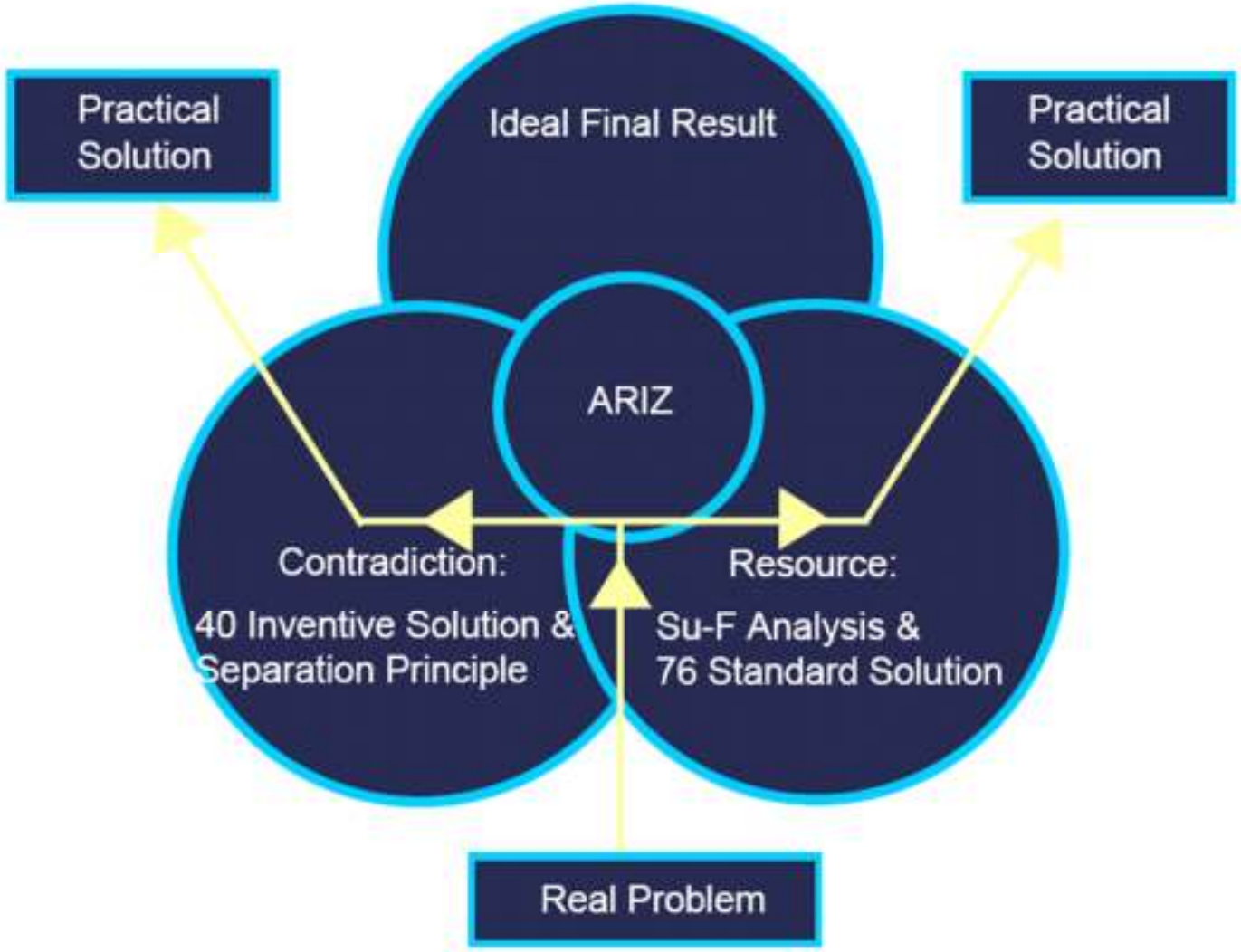
Unified and Simple Understanding



"Christmas Tree" diagram.

Samsung Experience (2004)

Unified and Simple Understanding



TRIZ in Software Development

Using TRIZ for Anti-Virus Development- Building Better Software Through Continuous Innovation

by Umakant Mishra (Goodreads Author)

★★★★★ 4.67 · rating details · 3 ratings · 1 review

Both virus and anti-virus technologies have become matured. While virus creators want their creations to spread over the whole world, the anti-virus developers strive to catch even the last virus hidden inside any corner of a PC or network. While the simple viruses of early days have transformed to encrypted, polymorphic and metamorphic viruses, the simple scanning of earl...more

Want to Read

Rate this book

Paperback, First, 474 pages

Published July 1st 2013 by Umakant Mishra

more details... edit details

Abstraction database : CVE, Backtrack, internal ITIL CMDB, EA ADM, HelpDesk

TRIZ in Software Development

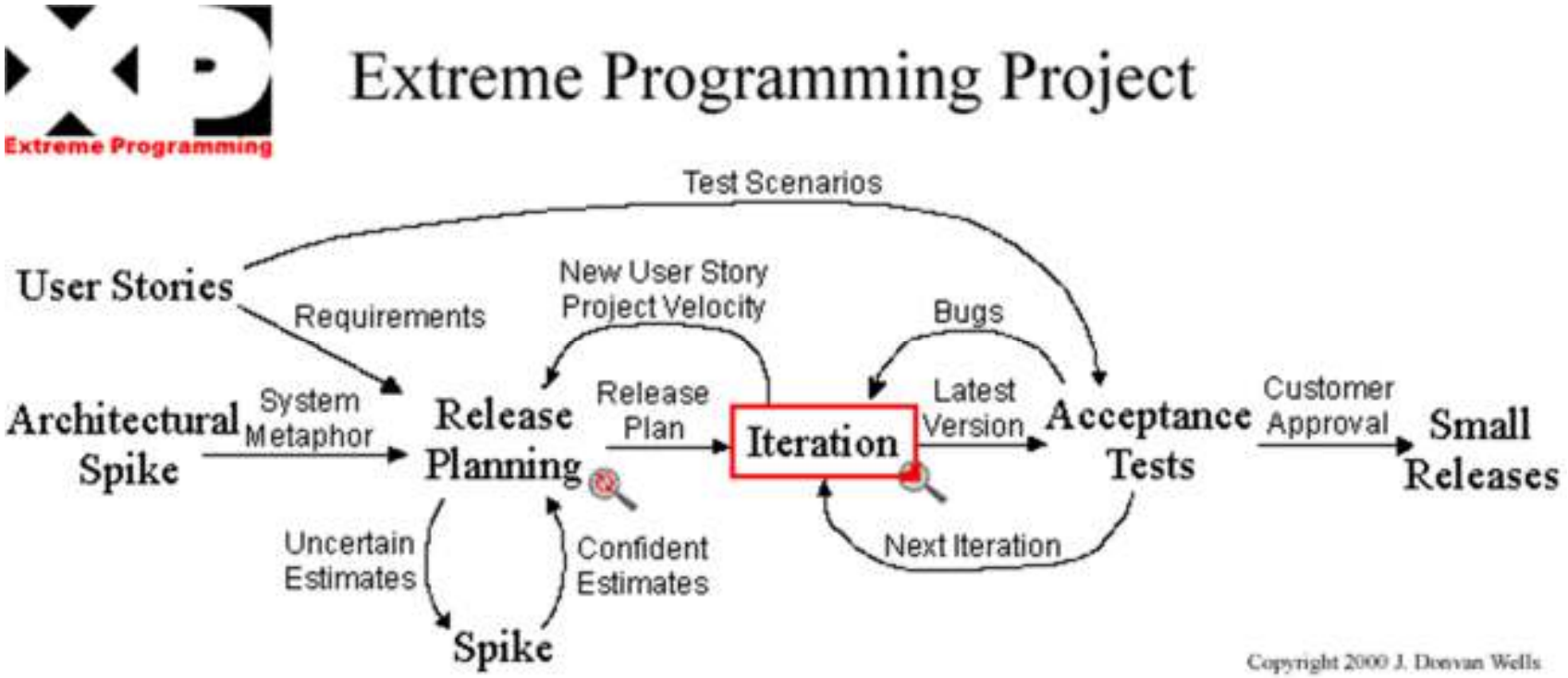
Previous academic works on adopting TRIZ in software

[1] “Fast Software by TRIZ”, Michael Schlueter, ETRIA World Conference - TRIZ Future 2003
[2] TRIZ and Software – 40 Principle Analogies, Part 1, Kevin Rea, TRIZ-journal 2001
[3] TRIZ and Software – 40 Principle Analogies, Part 2, Kevin Rea, TRIZ-journal 2001
[4] Applying TRIZ to Software Problems, Kevin Rea, TRIZCON2002
[5] TRIZ and Software, Graham Rawlinson, TRIZCON2001
[6] Hands on systematic innovation, Darrell Mann 2002
[7] Managing the Software Process, Watts S. Humphrey, 1989
[8] Software Project Survival Guide, Steve McConnel, 1998
[9] Non-Functional Requirements in Software Engineering, L. Chung, 2000

The translation from these Inventive Principles into Software is very difficult to use for many; even for very experienced TRIZ users. The translation made by Kevin Rea ([2] and [3]) is very helpful but only if you are working in a certain application area (in this case that of concurrent programming).

One contribution of TRIZ is the development of a fast and reliable algorithm using limited resources (such as memory size and processor speed). Further, the use of graphical representations (a major contributing factor of TRIZ in the field Mechanical Engineering) and formal methods, such as UML, to describe Software is quite common.

TRIZ in Software Development



Instead of running around for ideas, XP team's user members can pictur-ize their requirements into similar physical products and technological process such that the ideality of target systems can be revealed immediately . TRIZ component analysis and trimming process can help

Case Sharing – Internet Mining

An institute in Shanghai/Guangzhou wants to develop a high speed internet mining equipment for carrier switch.

Specifications are

1. Can handle traffic from 2 billions MAC addresses (including both mobile devices and fixed computing devices);
2. Cope with high data velocity, says 500 GB per second
3. Can perform the following data mining and fuzzy logic analysis (Support Vector Modeling, K-mean clustering, Event Chain Analysis, Grey Relations Analysis)
4. Storage are archived in non-SQL format
5. Horizontal scalability with cross location ability
6. No propriety item

Case Sharing – Internet Mining

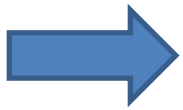
High level function analysis

- Need stateful connections for event chain analysis
- Need straight through numeric crunching
- Wish to have a pipeline data bus
- Cheap process
- Standard PCB bus, preferably PCI or VME

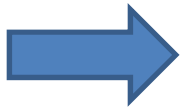
Ideas transfer

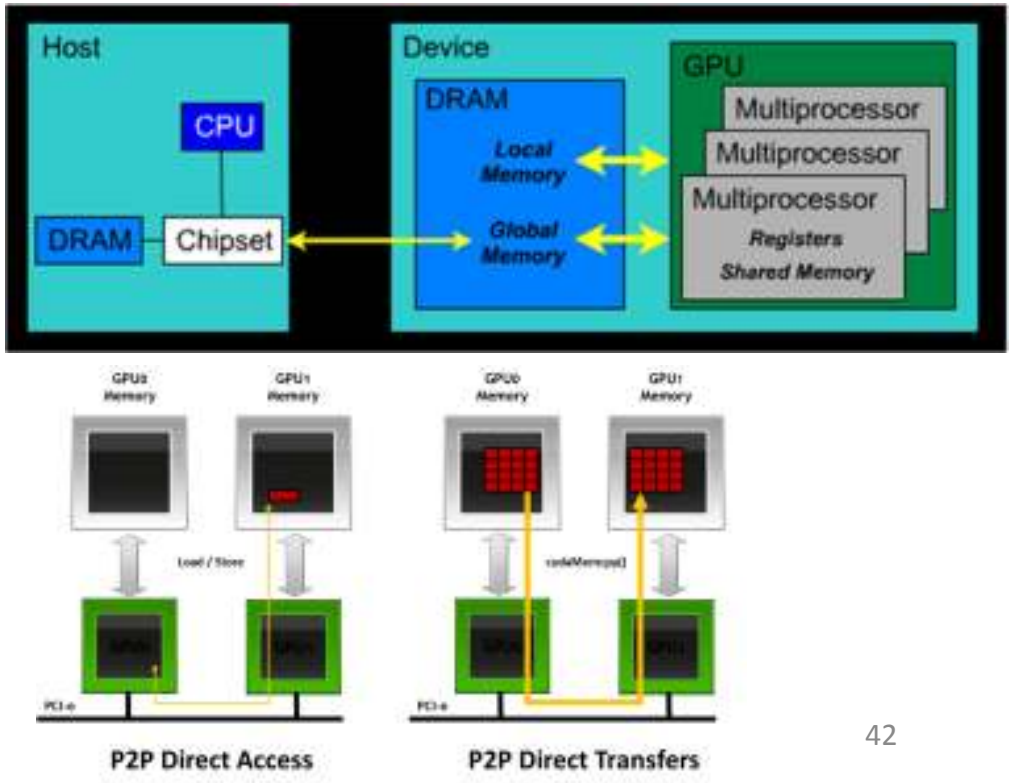
Case Sharing – Internet Mining

Ideas transfer

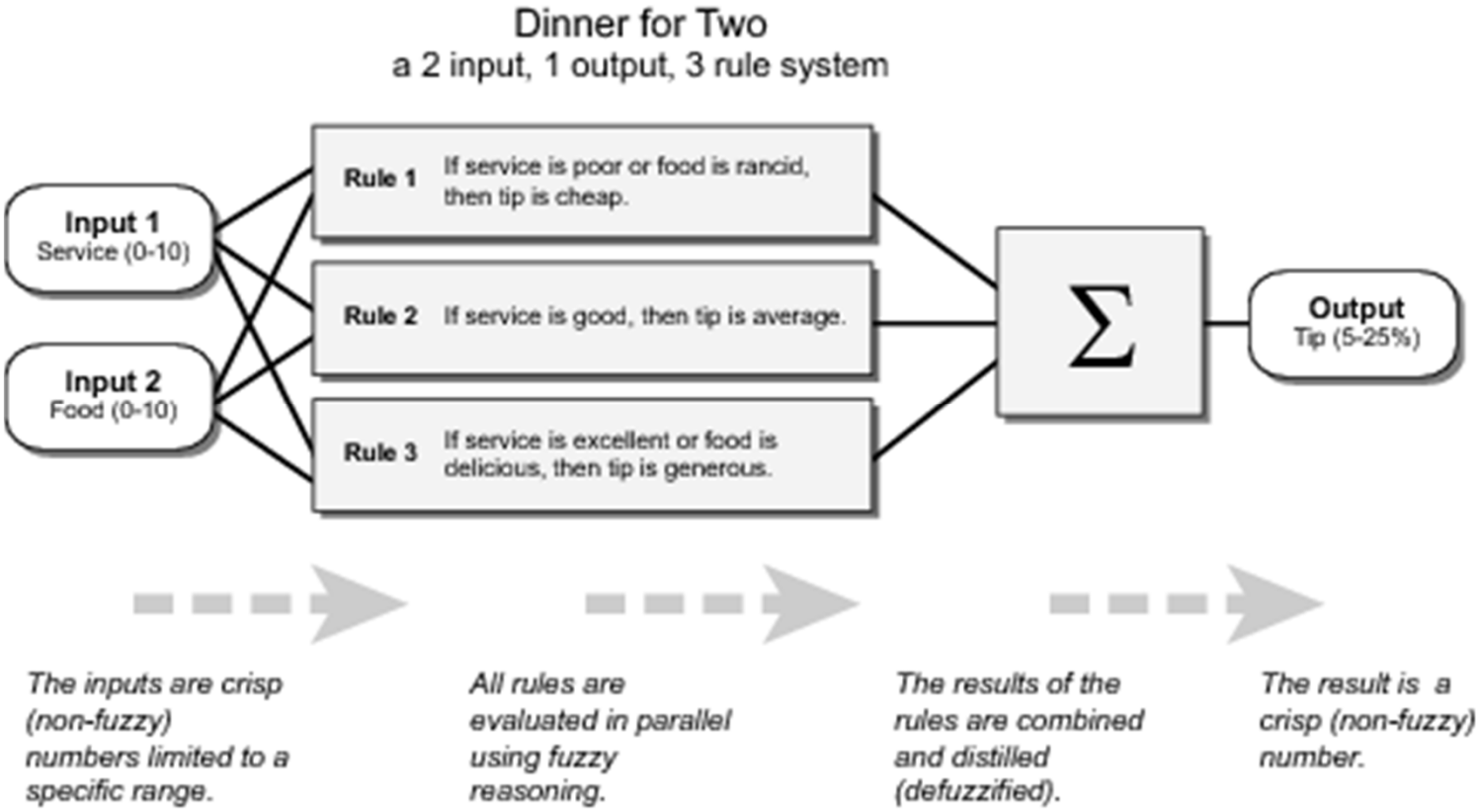


- One instance supports 2 millions connections, auto redundant
- Portable C routines





Case Sharing – Internet Mining



Fuzzy logic operation demands a lot of temporary memory stores, and the same for genetic algorithm through automata. X86 architecture of PUSH/POP register demands more clock cycles for this automata operation. The Context memory In GPU CUDA provides a straight-through process at ASIC level, and there is physical boundary serving as Poka Yoke against potential C-stack memory leaking such that a lean data flow is established to facilitate a data mining pipeline operation at much fewer clock cycles (cheap process).

Case Sharing – Retails

Current issues in Shanghai Retailing

1. Rent rises 2 times every six months
2. High land cost, such as the latest Sun Hung Kai Properties winning the land auction in Xu Jia Hui for 27 Billion RMB
3. Fast change in customer tastes
4. Around 500,000 wealthy second generations with 300 KM of Shanghai
5. Demand high level of personalization

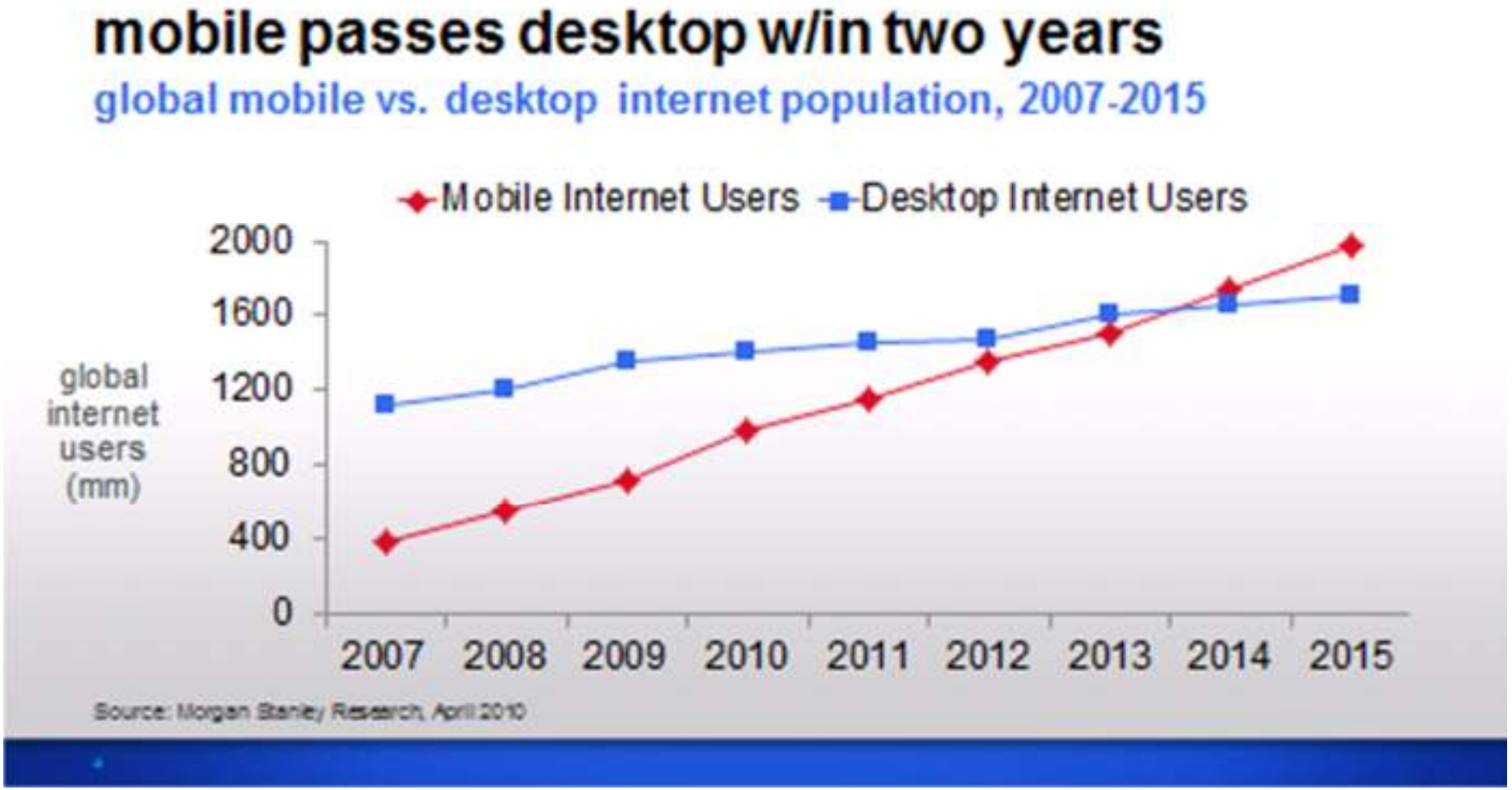
6. Do S-Curve and MPV

Case Sharing – Retails

- A Latin teacher
- Gets a iPAD
- Register 1st GMAIL
- Amazon shopping and online grocery
- Upload youtube

Case Sharing – Retails

Case Sharing – Retails



Case Sharing – Retails

Peapod, P&G tap mobile to simplify grocery shopping for commuters

By Chantal Tode

February 10, 2012

Commuters can "shop" posters at transit stations

Internet grocer Peapod, Coca-Cola and Procter & Gamble's Charmin are giving smartphone owners in Philadelphia another way to shop for groceries while they commute to work.

Posters at Philadelphia transit stations feature a variety of commonly purchased grocery items along with QR codes that commuters can scan with the

Case Sharing – Retails

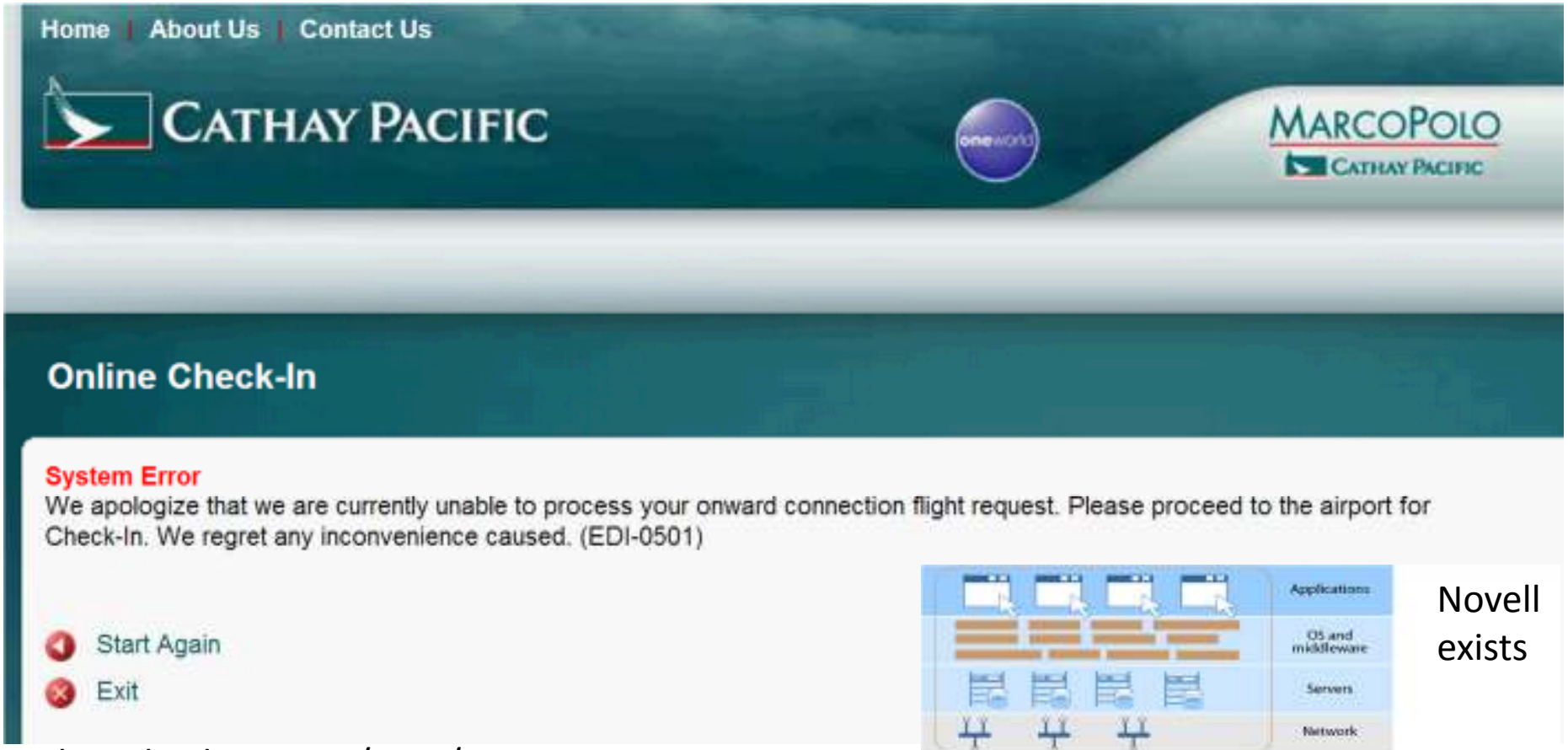
Green areas : major PRC trading partners, and have a lot of Chinese livings

Case Sharing – Retails

环太湖500K 富二代和军二代
“弈向零售”

Q2Q

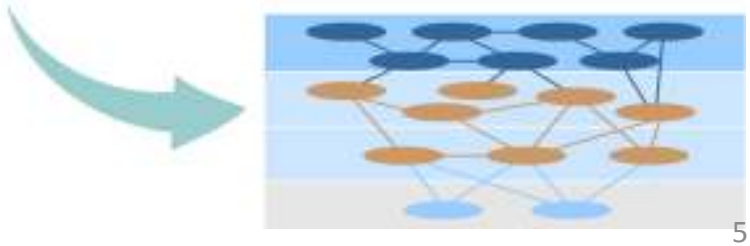
Challenges



Novell exists

Online check-in: HKG/AMS/LHR

Enterprise bus issue? Access rights issue? Outsourcer?



Enterprise Architecture resolves the issue through contradiction management (TRIZ)?

Challenges

TRIZ is good at IT Control Systems issues, such as applicator, robots, surveillance and motion detection, ASIC computers, sensors, telecommunication and kernel levels programming.

Application could be iOS battery consumption routine.

Business Application - an attempt to integrate with Soft System Methods (from U. of Lancaster) and EA

References

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