Innovation in Service Delivery
TRIZ in IT & Retail

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CF401 PolyU

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Table of Content

a) My Background
b) What is TRIZ?
c) Samsung Experience (2004)
d) TRIZ in Software Development
e) Case sharing - internet mining on GPU and Retail SoLoMoCo
f) Supplementary slides (40 inventive principles)
My Background

Scope of business

Digital textile printing

Internet mining & tracking research

Mobile Retailing

So Lo Mo Co
Innovation Types

Transaction innovation

Product innovation

Process innovation

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

My status quo
What is TRIZ

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.
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
THINKING ANALOGICALLY
(WITHOUT AN EGO)

THE WORLD’S PROBLEMS → THE WORLD’S SOLUTIONS

MY PROBLEM ↓

MY SOLUTION ↑

What is TRIZ
Many Typical Problems

A large number of typical problems are available for consideration

Many Typical Recommendations for Solutions (Knowledge base)

TRIZ helps narrow the search to a manageable range of typical problems

For each typical problem, there are one or more potential solutions
## Ideas Transition

<table>
<thead>
<tr>
<th><strong>Given system</strong></th>
<th><strong>System - analog</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Filter cleaning</strong></td>
<td><strong>Sweet pepper canning method</strong></td>
</tr>
</tbody>
</table>

**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.

**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.
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
What is TRIZ

Function Analysis

Component Analysis

Interaction Analysis

Function Modeling
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 of 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.
What is TRIZ

Subway Auto Fare Collection

Contradiction

High speed transmission versus security & resilience

Tailgating versus recognition time
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
What is TRIZ

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

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<thead>
<tr>
<th>Worsening Feature</th>
<th>Improving Feature</th>
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<tr>
<td>Weight of stationary object</td>
<td>Volume of stationary object</td>
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<tr>
<td>Length of moving object</td>
<td>Speed</td>
</tr>
<tr>
<td>Area of stationary object</td>
<td>Force (Intensity)</td>
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<td>Volume of moving object</td>
<td>Stress or Pressure</td>
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<td>Stability of the object components</td>
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22
### What is TRIZ

**TRIZ – 40 Principles**

| 1. Segmentation                      | 21. Skipping                   |
| 2. Taking out                        | 22. Blessing in disguise       |
| 3. Local quality                     | 23. Feedback                   |
| 5. Merging                           | 25. Self-service               |
| 7. Russian dolls                     | 27. Cheap short-lived objects  |
| 10. Preliminary action films         | 30. Flexible shells and thin   |
| 12. Equipotentiality                 | 32. Colour changes             |
| 13. "The other way round"            | 33. Homogeneity                |
| 14. Spheroidality - Curvature        | 34. Discarding and recovering  |
| 15. Dynamics                         | 35. Parameter changes          |
| 16. Partial or excessive actions     | 36. Phase transitions          |
| 17. Another dimension                | 37. Thermal expansion          |
| 18. Mechanical vibration             | 38. Strong oxidants            |
| 19. Periodic action                  | 39. Inert atmosphere           |
| 20. Continuity of useful action      | 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

- Logic for problem diagnostics and analysis, problem reformulation, system analysis
- Inventive Principles and Patterns that define new "out of the box" solution strategies
- Analytical Logic
- Knowledge Bases
- TRIZ and Systematic Innovation
- Philosophy and methodology of innovative problem solving

System thinking, contradiction-oriented thinking, resource thinking, Theory and Trends of Technology Evolution
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
Evolution of the TRIZ Methodology

What is TRIZ

Methodology Advancement


Kishinev Era

Classical TRIZ Era

Re-Structuring of Theoretical Base

Advanced Software Tools

Advanced Tools

Directed Evolution

Non-Technological Applications

ARIZ-85

40 Principles

Patterns of Evolution

ARIZ-85

AFD

Ideation/TRIZ Era

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. (Ikovenko, 2013)
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)

"Christmas Tree" diagram.
Samsung Experience (2004)

Unified and Simple Understanding

- Practical Solution
- Ideal Final Result
- Practical Solution

ARIZ

Contradiction:
- 40 Inventive Solution & Separation Principle

Resource:
- Su-F Analysis & 76 Standard Solution

Real Problem
Abstraction database: CVE, Backtrack, internal ITIL CMDB, EA ADM, HelpDesk
Previous academic works on adopting TRIZ in software

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.
Instead of running around for ideas, XP team’s user members can picture-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.
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
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).
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
mobile passes desktop w/in two years

global mobile vs. desktop internet population, 2007-2015

Source: Morgan Stanley Research, April 2010
Case Sharing – Retails

Home plus subway virtual store

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

By Chantal Tode

February 10, 2012

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

Commuters can “shop” posters at transit stations

Virtual shopping gets real at Toronto subway station

MARINA STRANG — TORONTO STAR
From Toronto’s Globe and Mail
Published Monday, Apr. 09, 2012 8:58 PM EDT
Last updated Tuesday, Apr. 10, 2012 11:28 AM EDT

A new front in virtual retailing has arrived: a wall at a busy subway station.

An online health and beauty retailer on Monday launched a pop-up store at a key commuter hub that features images of hammer, screwdriver and blue jeans — rather than the products themselves. Using a smartphone app, shoppers place their orders by scanning quick response codes — QR codes, for short — on pictures of products, which are then shipped, often as quickly as the next day, to customers free of charge.

"We are constantly looking for ways to reach consumers where they spend the most time," said one executive.

"It’s a great way to get our products into the hands of customers who may not have access to our website," she added.
Green areas: major PRC trading partners, and have a lot of Chinese livings
环太湖500K 富二代和军二代
“弈向零售”

So Lo Mo Co

Q2Q
Challenges

Online check-in: HKG/AMS/LHR

Enterprise bus issue? Access rights issue? Outsourcer?

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


