

TRIZ Development at Intel Corporation

Japan TRIZ Symposium 2008



Amir Roggel
Principal Engineer
Intel Israel



Agenda

Innovation at Intel

TRIZ history at Intel

TRIZ Role and Proliferation

TRIZ as an Intel methodology



The 20th Century

~1900

~2000

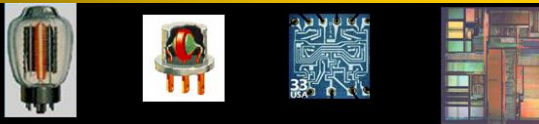
Automobiles



Airplanes



Electronics



Telephone

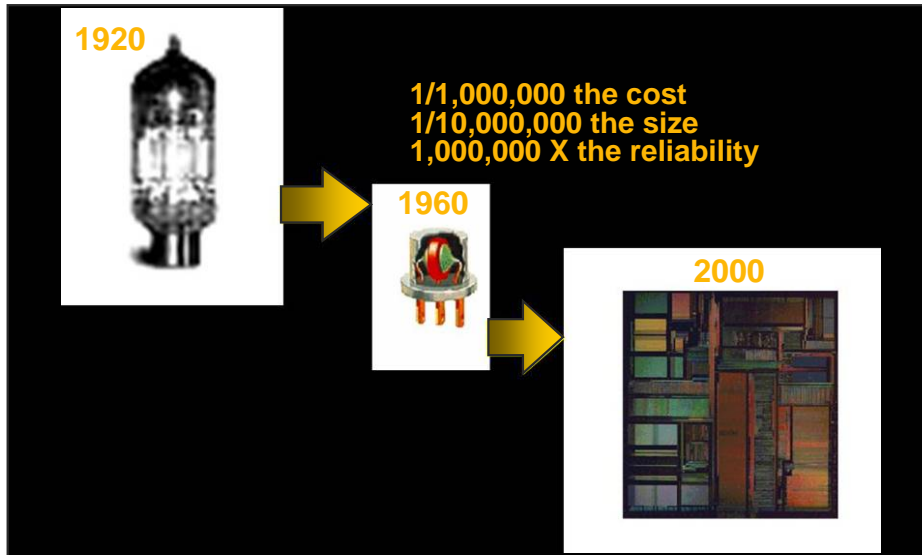


Radical Innovation

- Goes beyond competitive positioning
- May lead to major paradigm shift
- Usually an individual achievement; champion driven
- Risky with high failure rate; rare in mature companies



Radical Innovation

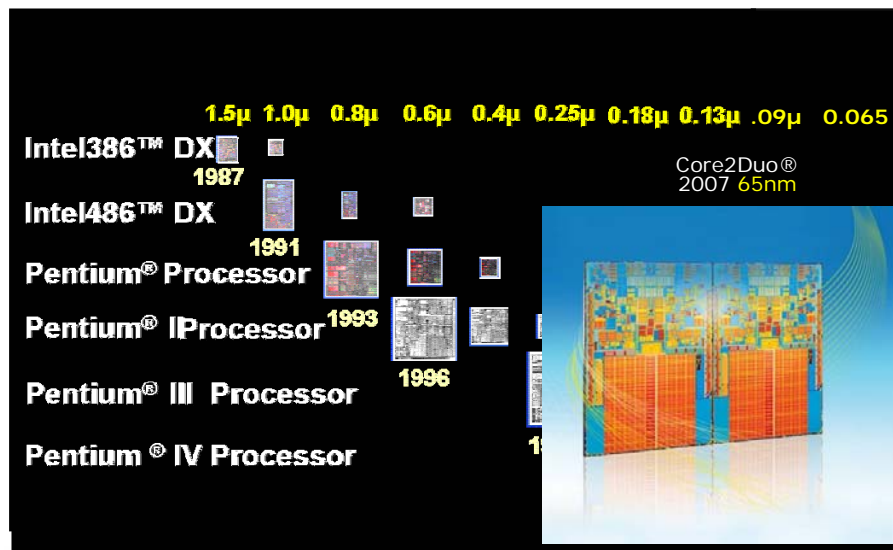


Incremental Innovation

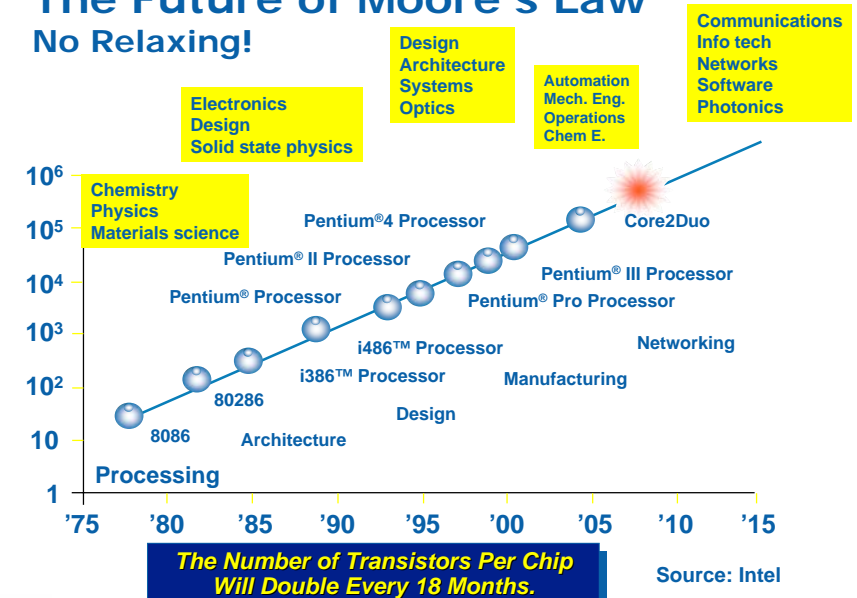
- Address issues in non-traditional ways
- Necessary to retain competitive position but does not threaten status quo
- Responsive to problems, opportunities or trends
- Team driven; high expectation of success
- Lots of recognition and reward for success



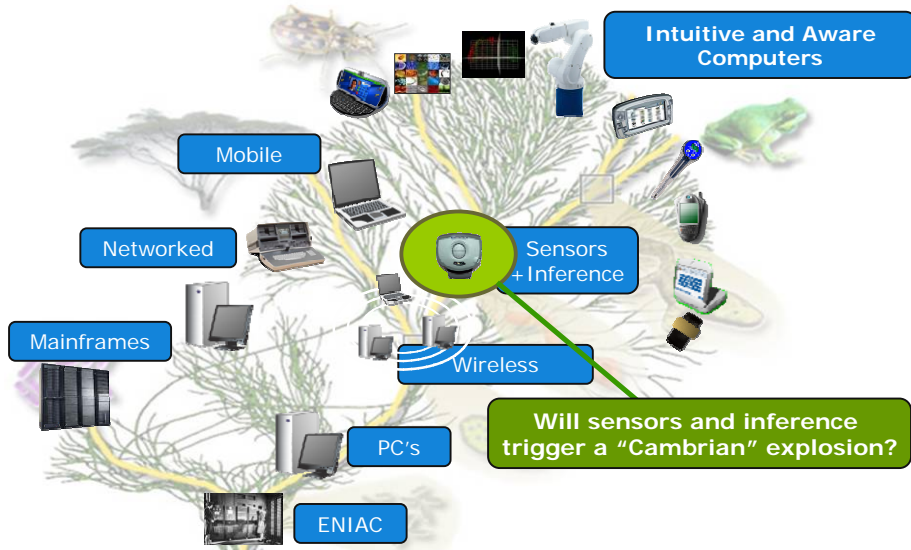
Incremental Innovation: Moore's Law



The Future of Moore's Law No Relaxing!



CPU – the Brain of Evolving Computing Platforms



Courtesy Andrew Chien – VP and Director, Intel Research
(C) The Author & Japan TRIZ Society Slide 9

Japan TRIZ Symposium 2008 September 10, 2008

20th Century Top Science and Technology Achievements *

- | | |
|------------------------------------|--------------------------------|
| 1. Electrification | 11. Interstate highways |
| 2. Automobile | 12. Space flight |
| 3. Airplane | 13. Internet |
| 4. Water supply & distribution | 14. Imaging |
| 5. Electronics | 15. Household appliances |
| 6. Radio and television | 16. Health technologies |
| 7. Agricultural mechanization | 17. Petrochemical technology |
| 8. Computers | 18. Laser and fiber optics |
| 9. Telephone | 19. Nuclear technologies |
| 10. Air conditioning/refrigeration | 20. High-performance materials |

* National Academy of Engineering;
“A Century of Innovation”

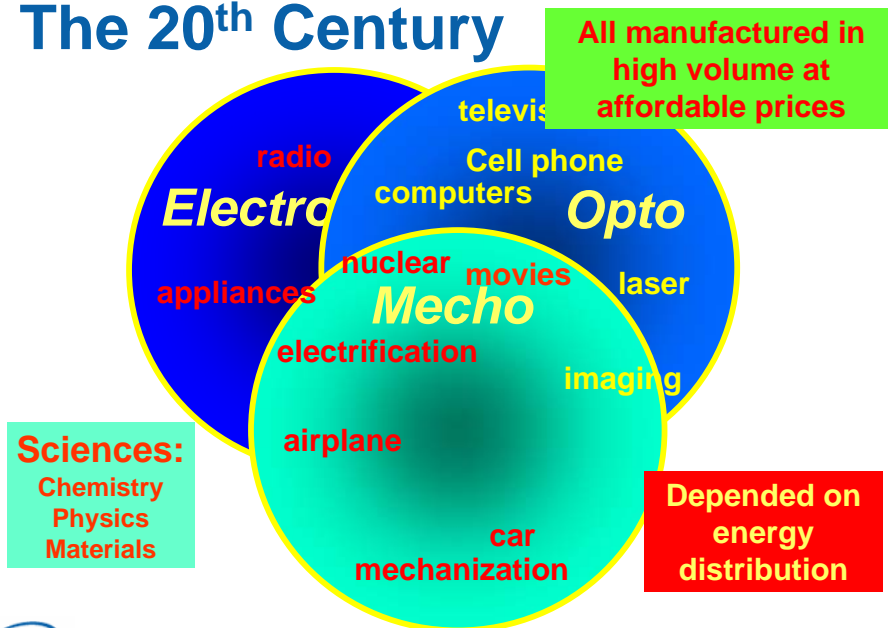
Providing ubiquitous power was
a key to success in the 20th century



Courtesy Gene Meieran, Senior Intel Fellow
(C) The Author & Japan TRIZ Society Slide 10

Japan TRIZ Symposium 2008 September 10, 2008

The 20th Century



(C) The Author & Japan TRIZ Society Slide 11 Japan TRIZ Symposium 2008 September 10, 2008

21st Century Top Science and Technology Achievements *

- | | |
|--|---|
| <ul style="list-style-type: none"> ■ Energy conservation ■ Resource protection ■ Food & water and supply ■ Waste management ■ Medicine and prolonging life ■ Security & counter-terrorism ■ Education and learning ■ Genetics and cloning ■ Knowledge sharing ■ Global communication | <ul style="list-style-type: none"> ■ Traffic/population logistics ■ Natural disaster control ■ AI, interfaces and robotics ■ Electronic environment ■ Globalization ■ Space exploration ■ Preservation of species ■ Entertainment ■ “Virtualization” and VR ■ Preservation of history |
|--|---|

*Gene Meieran prediction; IFF votes

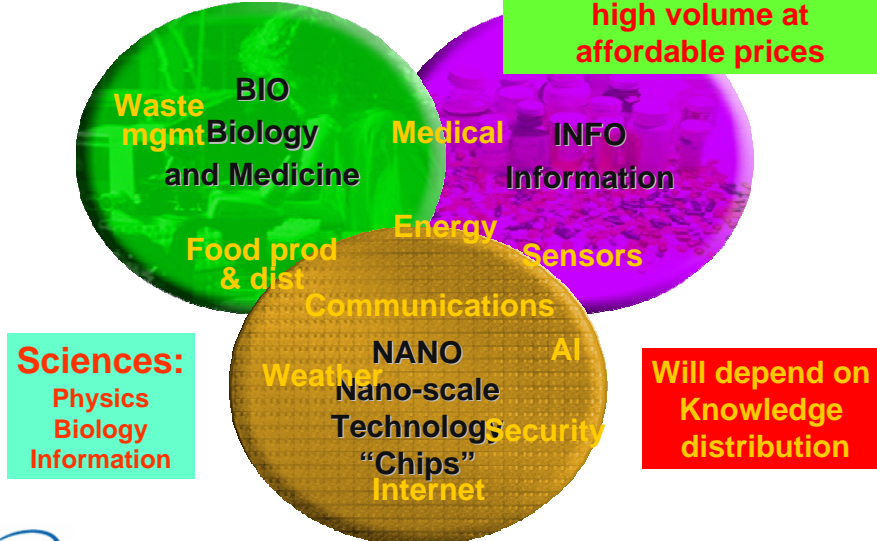


Courtesy Gene Meieran, Senior Intel Fellow
(C) The Author & Japan TRIZ Society Slide 12

Japan TRIZ Symposium 2008 September 10, 2008

The 21st Century

All to be manufactured in high volume at affordable prices



TRIZ at Intel

- History
- Proliferation
- Problem solving
- Applications: Present and Future

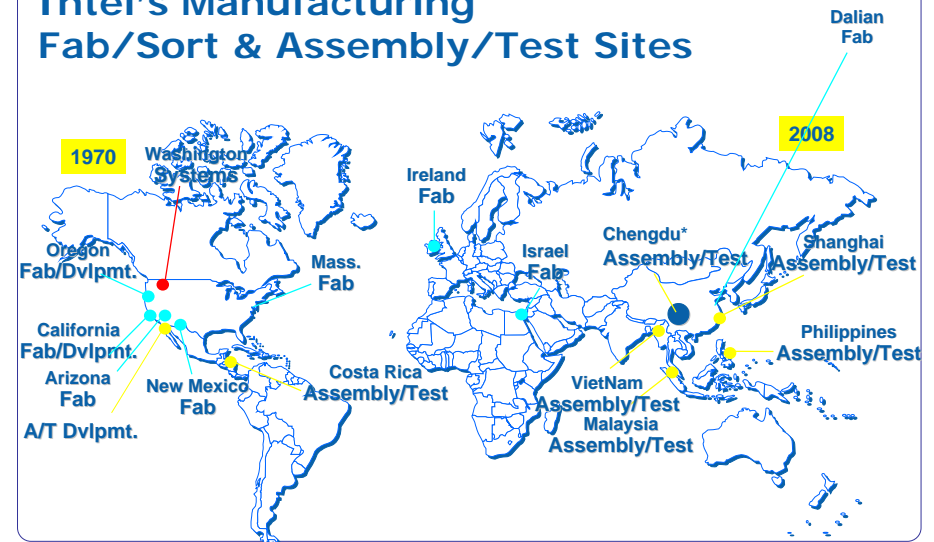


TRIZ at Intel

- 1996-2001 Exploration stage
 - 1996, Santa Clara Technology Development - Began TRIZ software pilot/training. Two very successful projects – “Sputnik” and “Bubbles”
 - 1998 Introduced to Assembly Technology Development and Flash Business
- 2002-2004 Early deployment and seeding in Mfg.
 - 2002 First TRIZ class in Assembly/Test Mfg. – Cavite, Philippines
 - 2003 First class in Fab/Sort Mfg. – Kiryat Gat, Israel
 - 2004 Classes in more sites (Fab/Sort and Assembly/Test)
- 2005-2006 Adoption – Manufacturing world-wide
 - 2005 First classes to Level-2 and Level-3
 - 2006 All Level-1, Level-2 classes delivered internally
- 2007-> into the future
 - Manufacturing expansion and beyond



Intel’s Manufacturing Fab/Sort & Assembly/Test Sites



Intel TRIZ Conference Chandler, Arizona - Dec 2007

- Intel wide conference held in 2007.
- Conference Theme: "Innovating the Future"
- Over 150 attendees from around the world (40 non-US).
- 6 papers, 28 posters showcasing work across multi-disciplines
- Invited talks by Intel Fellows, industry experts, TRIZ masters



(C) The Author & Japan TRIZ Society Slide 17 Japan TRIZ Symposium 2008 September 10, 2008

Mark Barkan – MA-TRIZ President



(C) The Author & Japan TRIZ Society Slide 18 Japan TRIZ Symposium 2008 September 10, 2008

Problem Solving Framework at Intel

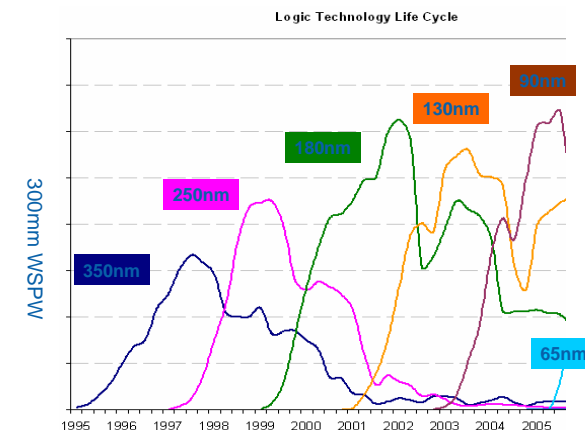
- Why problem solving is so critical in our current business model
- Our current problem solving culture
- Our manufacturing objectives
- Types of problems we solve
- How TRIZ fits in
- Future vision of TRIZ at Intel



(C) The Author & Japan TRIZ Society Slide 19 Japan TRIZ Symposium 2008 September 10, 2008

Why is it important for Intel to solve manufacturing problems quickly?

Each new technology has a shorter life cycle and requires a faster ramp rate than previous technologies. Problems incurred are much more costly per day of problem solving than they have ever been.



(C) The Author & Japan TRIZ Society Slide 20 Japan TRIZ Symposium 2008 September 10, 2008

Intel's Manufacturing Mission

To be the best in the world at:

Ramping new products into high volume

Yields

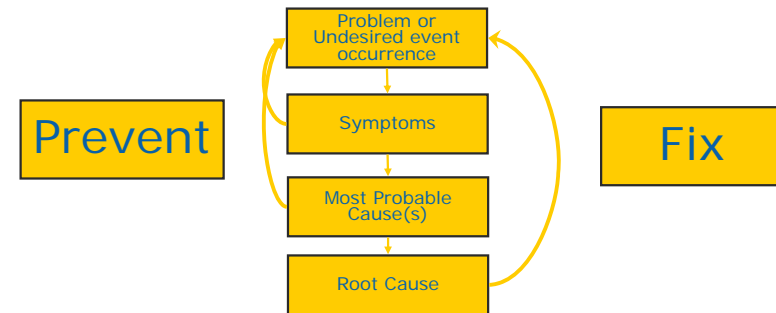
Tool productivity

Cost and agility

In order to achieve our goals, problems must be quickly contained, and with root cause understanding.



Intel's Problem Solving Culture and Methodology

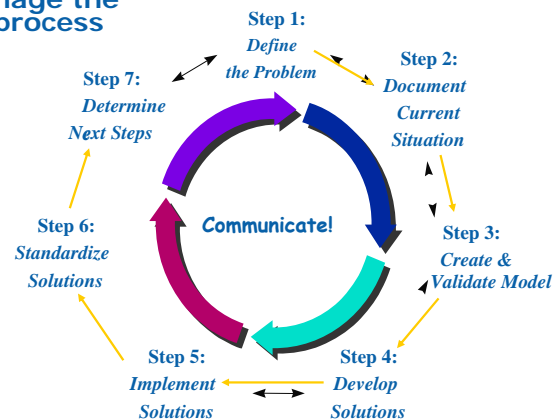


Problems are solved at different levels, with both time-to-solution and quality of solution in mind.



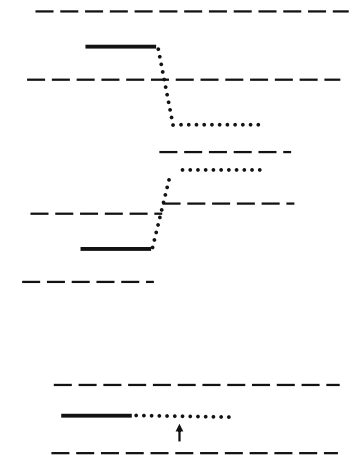
Managing the Problem Solving Process

Framework to manage the problem solving process



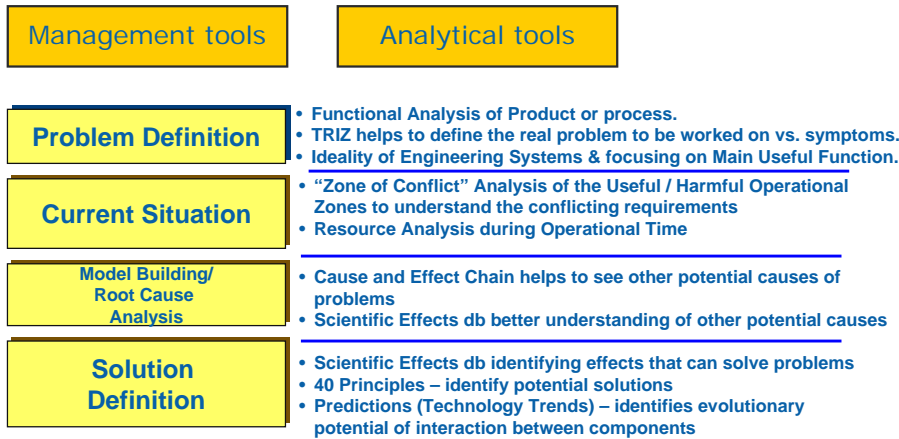
Types of Problems We Solve

- Corrective: Problems where a standard previously achieved is not being met Ex: excursion.
- Improvement: The current system or process performance, as it was designed, is expected to be improved Ex: Yield improvement.
- Preventive: Problems are where the goal is to add robustness and prevent systems or processes from failure or falling below baseline. Ex: Integrated process window centering



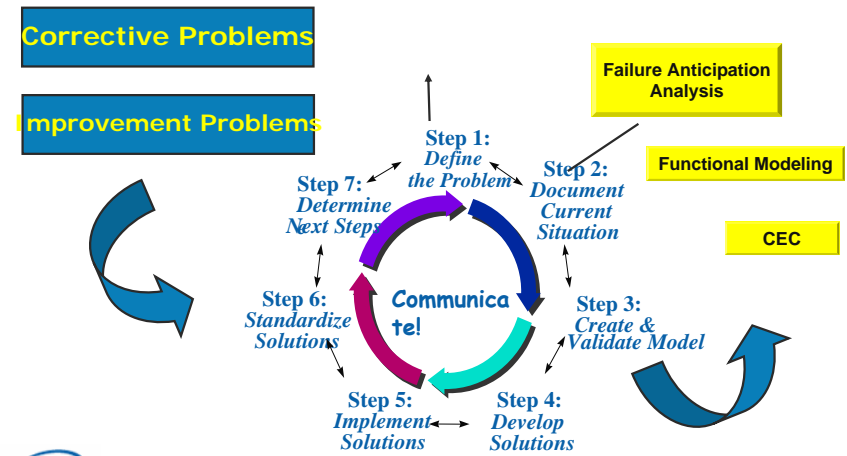
Analytic Tools for Problem Solving

- This is where TRIZ comes in...



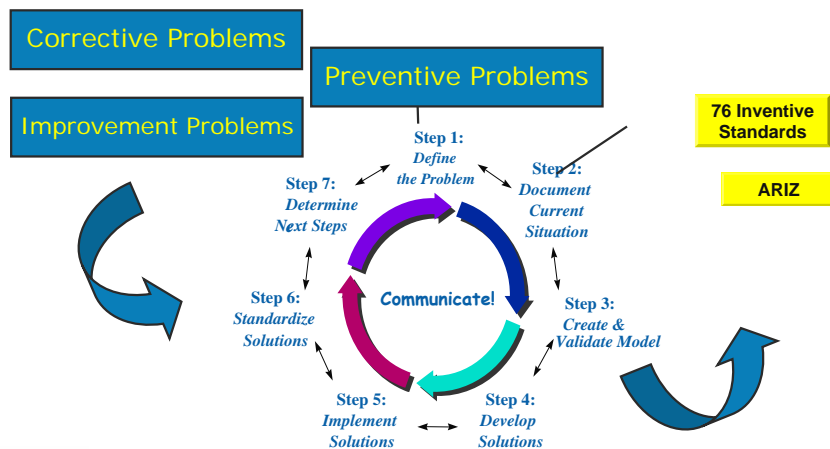
How the Problem Solving Model Fits Together

- Ramping new products into HVM



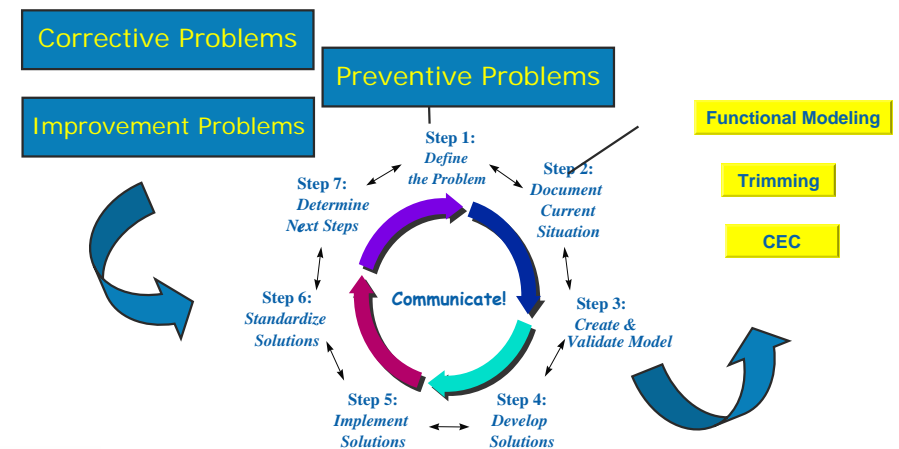
How the Problem Solving Model Fits Together

- Yields



How the problem solving model fits together

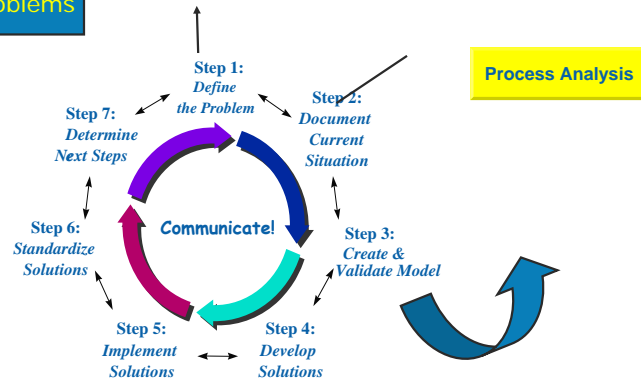
- Tool productivity



How the Problem Solving Model Fits Together

- Cost and agility

Improvement Problems



(C) The Author & Japan TRIZ Society Slide 29 Japan TRIZ Symposium 2008 September 10, 2008

Accomplishment and Challenges

- TRIZ has generated significant benefit for Intel as measured by time to solutions and cost saving
- Challenges in deployment of TRIZ in Intel
 - Strengthening existing uses
 - Propagate to new areas of use
- Tips for other companies who want to deploy TRIZ
 - TRIZ is not "Magic Wand": it requires hard work and investment, and deliver great results to those who do it
 - The 4 conditions required to make TRIZ successful in a company...



(C) The Author & Japan TRIZ Society Slide 30 Japan TRIZ Symposium 2008 September 10, 2008

Conclusions

- TRIZ is a key systematic innovation platform for Intel into 21st century
- Our manufacturing challenge: Improve productivity and efficiency without compromise
- Application of TRIZ in R&D and management are evolving: to improve and develop systems and processes throughout Intel
- TRIZ offers both tactical and strategic capability for companies. It is only the beginning...



(C) The Author & Japan TRIZ Society Slide 31 Japan TRIZ Symposium 2008 September 10, 2008

Acknowledgements



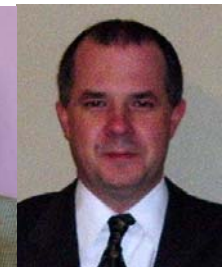
Mike Rocke



Kevin Brune



Dave Troness



Richard Platt

Our Visionaries and Champions



(C) The Author & Japan TRIZ Society Slide 32 Japan TRIZ Symposium 2008 September 10, 2008



David Austin
Principal Engineer
Intel Arizona



TS Yeoh
Principal Engineer
Intel Penang

Co Authors/leaders

Our Teachers



Sergei Ikoenko Alex Lyubomyskiy
(C) The Author & Japan TRIZ Society Slide 33

Our Sponsor



Gene Meieran
September 10, 2008

