

**A New Trend of Current Robotics Technology
and
Possibility of New Robotics Business**

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http://unit.aist.go.jp/is/index_e.html

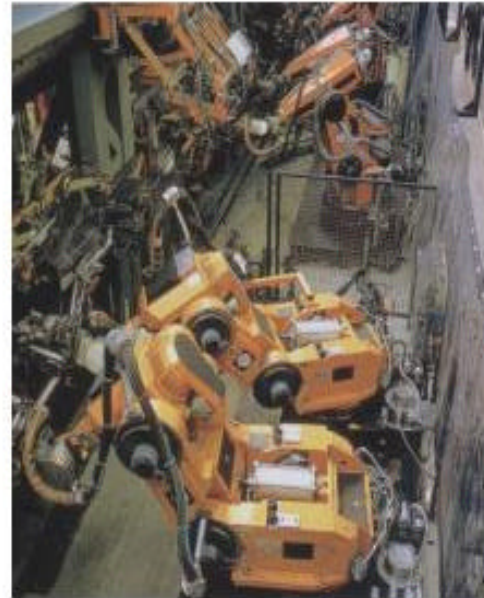
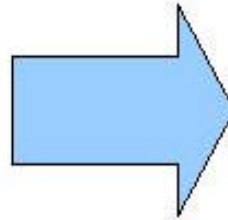
Contents

- 1. Current Status of Robotics Industry and relation between Technology and Industry Applications**
- 2. What is the Problem in Robotics Research?
- Robotics R/D and Business**
- 3. How New Robotics Business can be Developed via Advanced Robotics Research?**

Historical Issues in Robotics (1960 - present)



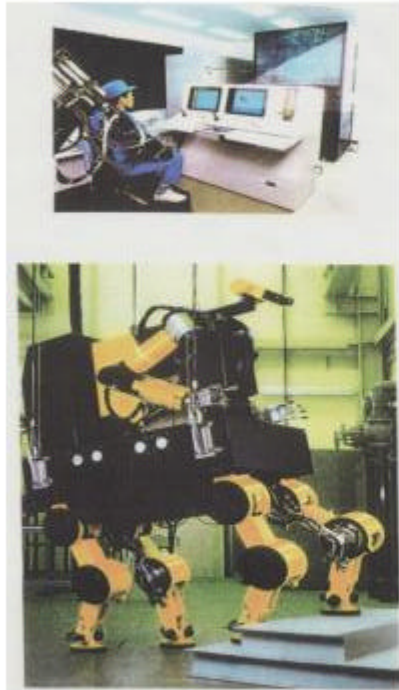
Automation



Industrial Robots

Manufacturing Automation

Maintenance Robots

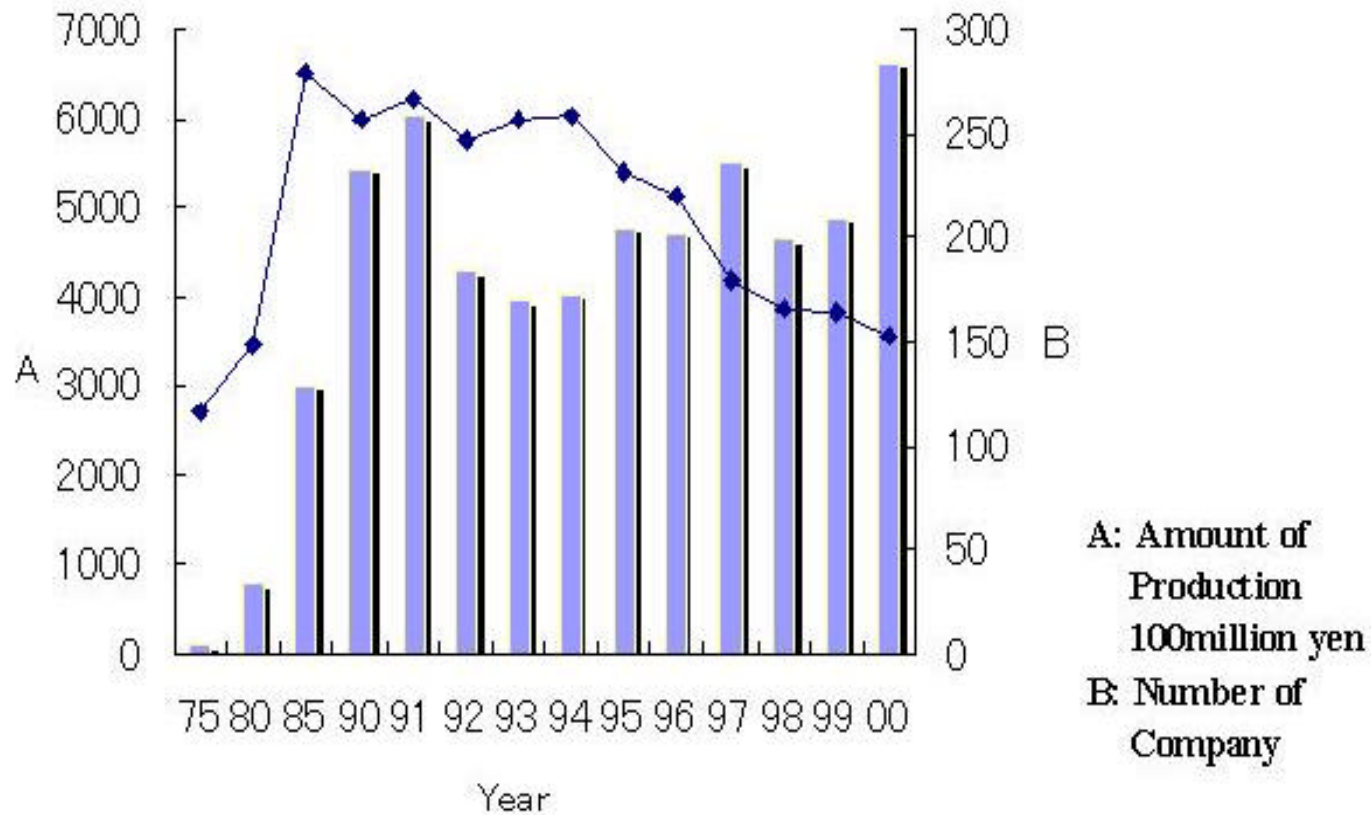


**Nuclear Plant Maintenance Robot (MITI)
(1983-1990, Advanced Robotics Project)**



**High Power Line Maintenance Robots
(Kyushu Electric Power/Yaskawa)**

Industrial Robot Production in Japan



Amount of Production in 2001: JPY 440B

Current Status of Robotics Industry in Japan

- **Total Amount of Production, JPY 660 Billion (in 2000)**
 - 60% of Total Industrial Robot Production in the world is “Made in Japan”
- **Major Users**
 - **Manufacturing Industry (Automobile, Home Electronic Products, etc) and Small Number of Non-Manufacturing Industry**
- **Type of Robot Conventionally Used**
 - **Position Control Based Teaching Playback Robot**
 - **Simple Pre-Programmed Robot**
 - **/Small number of Sensor-Based Control Robot.**

What Kinds of Robotics Technologies are Practically Useful?

Robotics Research Results practically applied so far:

- Teaching Playback Control**
- High-Stiffness Position Control**
- 2D Vision Based Manipulation**
- Off-line Teaching Robotic Simulator**
- Map-Based Mobile Robot Navigation**

Robotics Research Results with few applications:

(though a lot of papers for the topics have been presented at conferences)

- Legged Walking Robot**
- Obstacle Avoidance**
- Impedance Control**
- Knowledge-Based Autonomous Control**
- Path Planning**
- Multi-Robots System**

.....

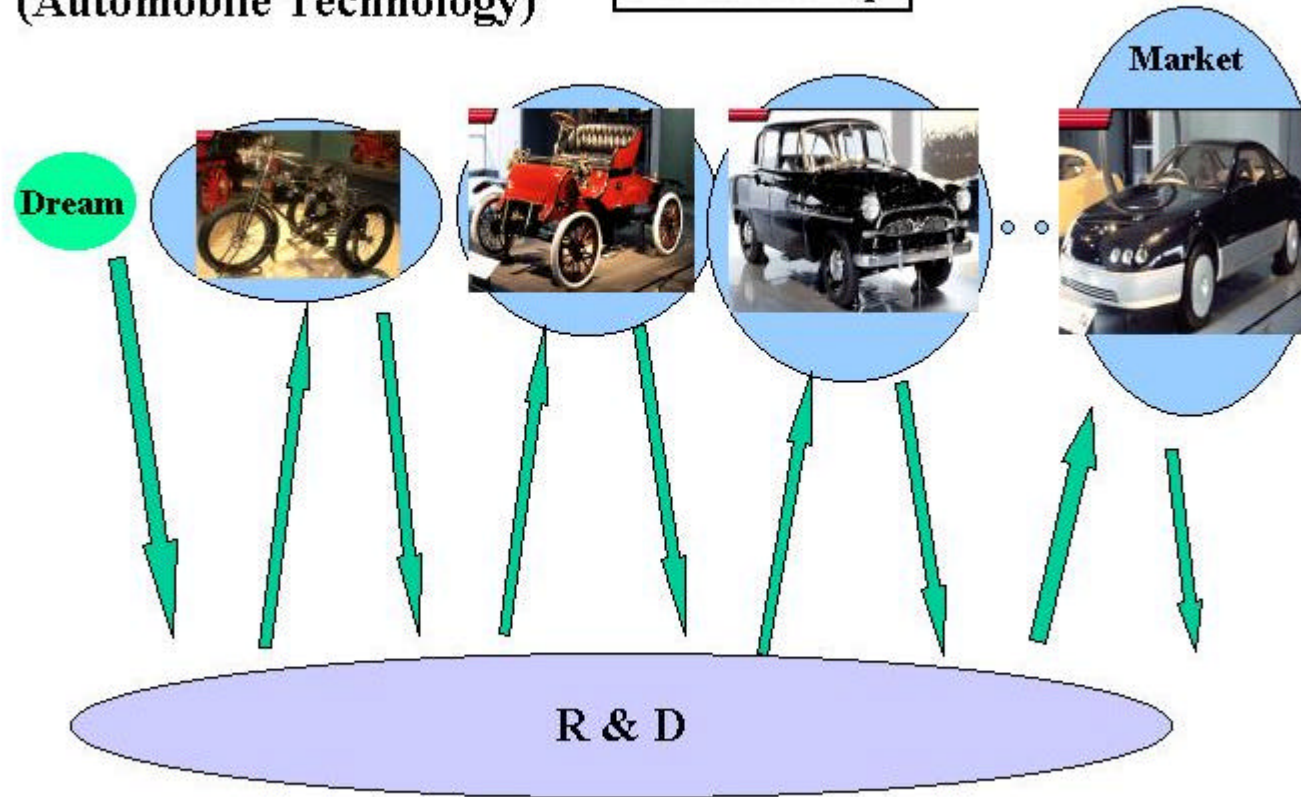
Why robotics research did not produce new business?

There was a misunderstanding that developing “new technical seeds” will automatically bring new business !

R&D and Business

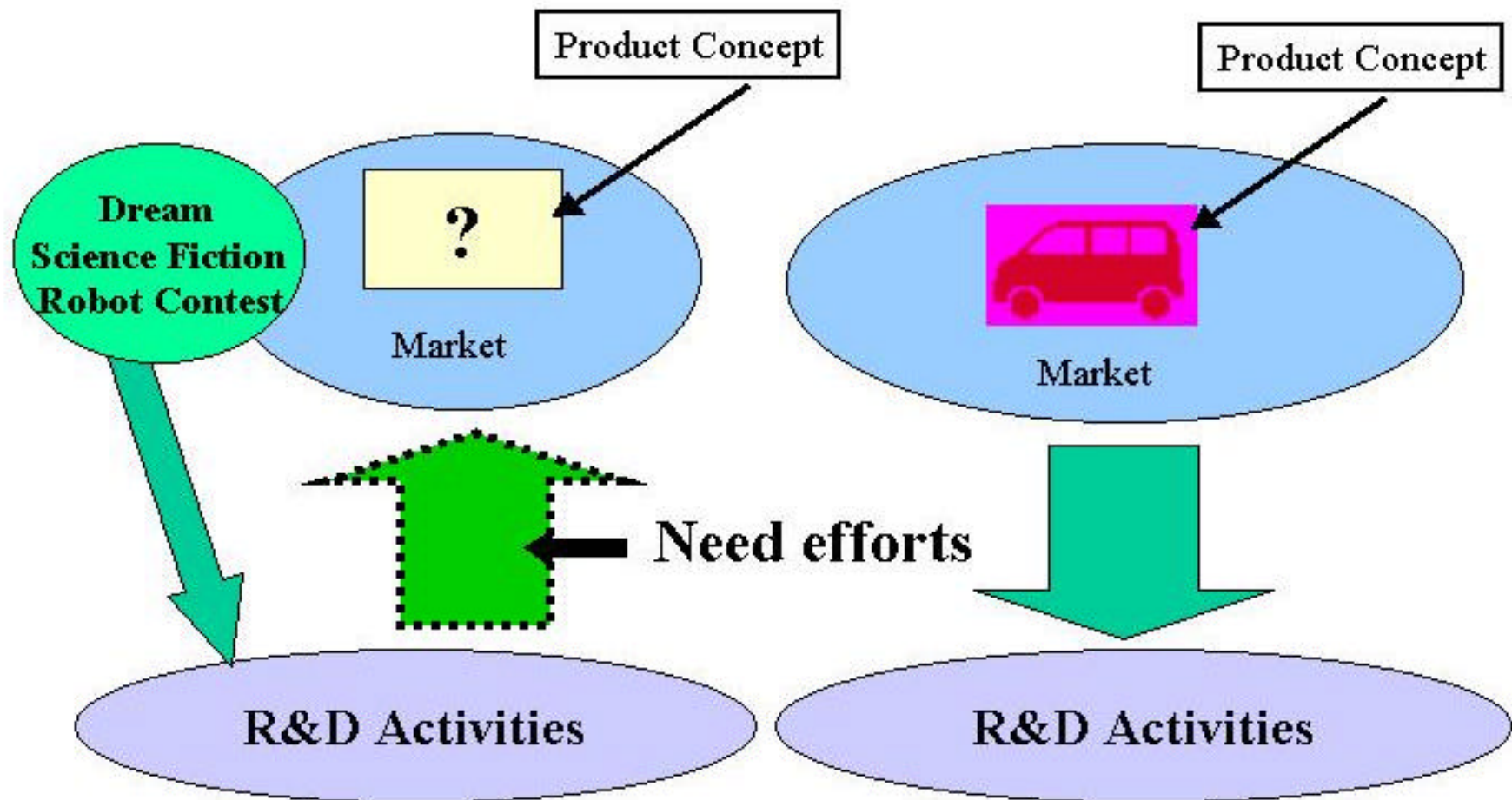
(Automobile Technology)

Product Concept



Robot Industry

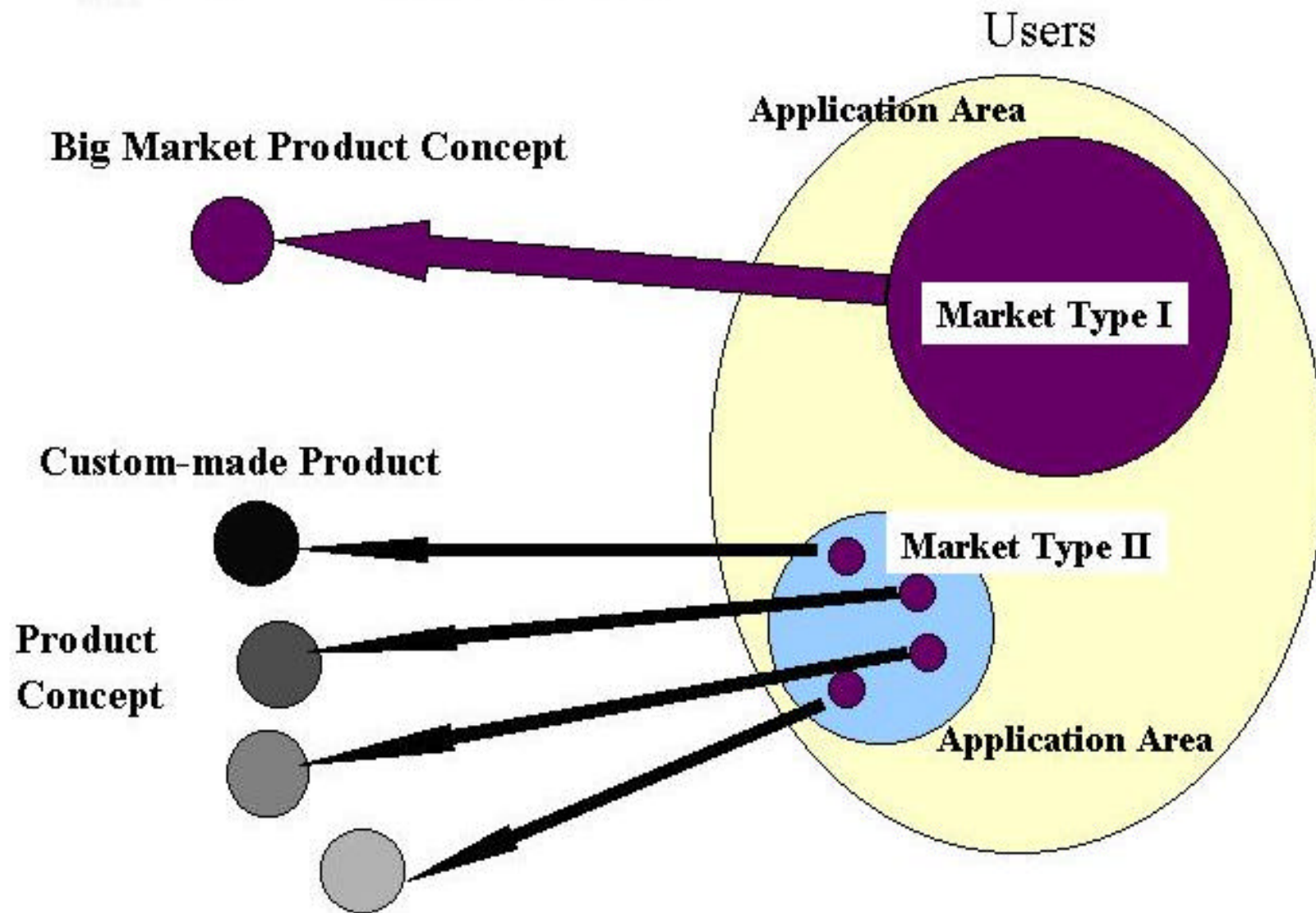
Car Industry



We need more efforts to develop new product concepts !

What kinds of Needs will be attractive for creating new product concepts which can draw many users' interests ?

Types of Product Market



Products for Type I Market Products (homogenous needs)

1. **Robotized home electronic products**
(Ex.: Vacuum cleaner robot...)
2. **Safety and Security robot**
3. **Information service robot (Papero, etc)**
3. **Entertainment robot**
(AIBO, PARO.....)
4. **Surgery robot**
5. **Robot for manufacturing automation in new future industry, like bio-industry...**



Specifications of Seal Robot, “Paro” (Ver.5)

CPU

32bit RISC

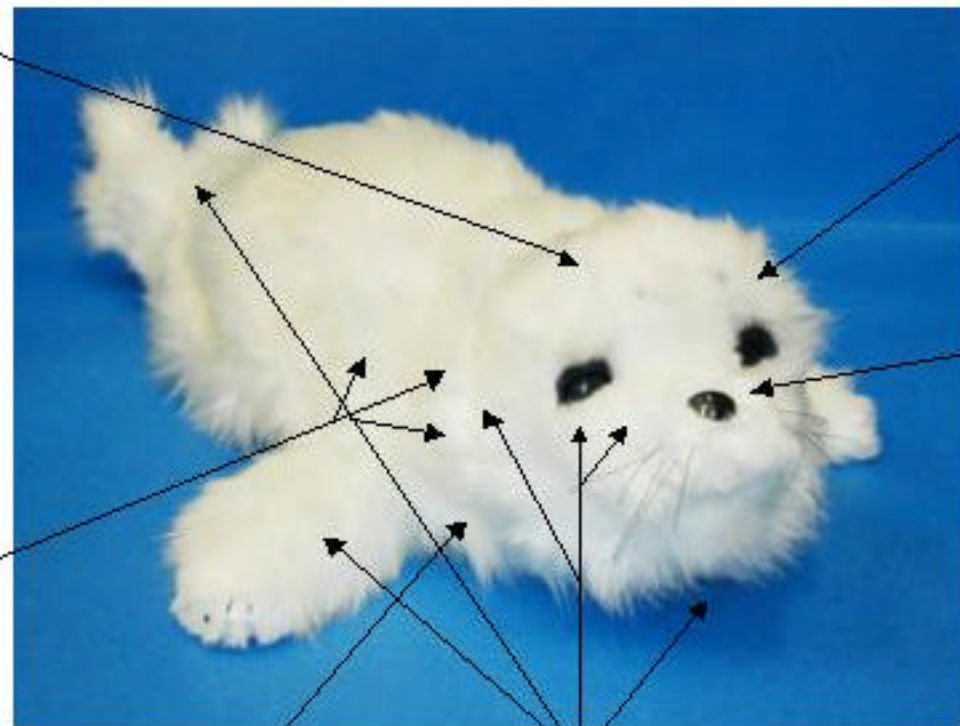
Weight

2.8 kg

Touch

• Tactile Sensor × 10

• Artificial Fur
(Anti-biotic)



Audition

Microphone × 2

Vision

Light Sensors
× 2

Posture Sensor **Actuator** × 8

neck(2), each front fin(1), rear fins(1),
upper & lower eyelid(2), rotation of eyes(1)

Industry Products Except Industrial Robots for Type I Market



Physical Therapy Robotic Device
(Yaskawa)



AIBO(SONY)



Meal Assistant Robot (SECOM)



Walking Training
Robot (Hitachi)



Fuji Heavy
Industry



Electrolux by
Toshiba

Vacuum Cleaner Robots

**Is It Possible to Develop
a Robot which can satisfy Type II market
needs?**

**The Answer is, maybe, “No”,
because each user request is very personal.**

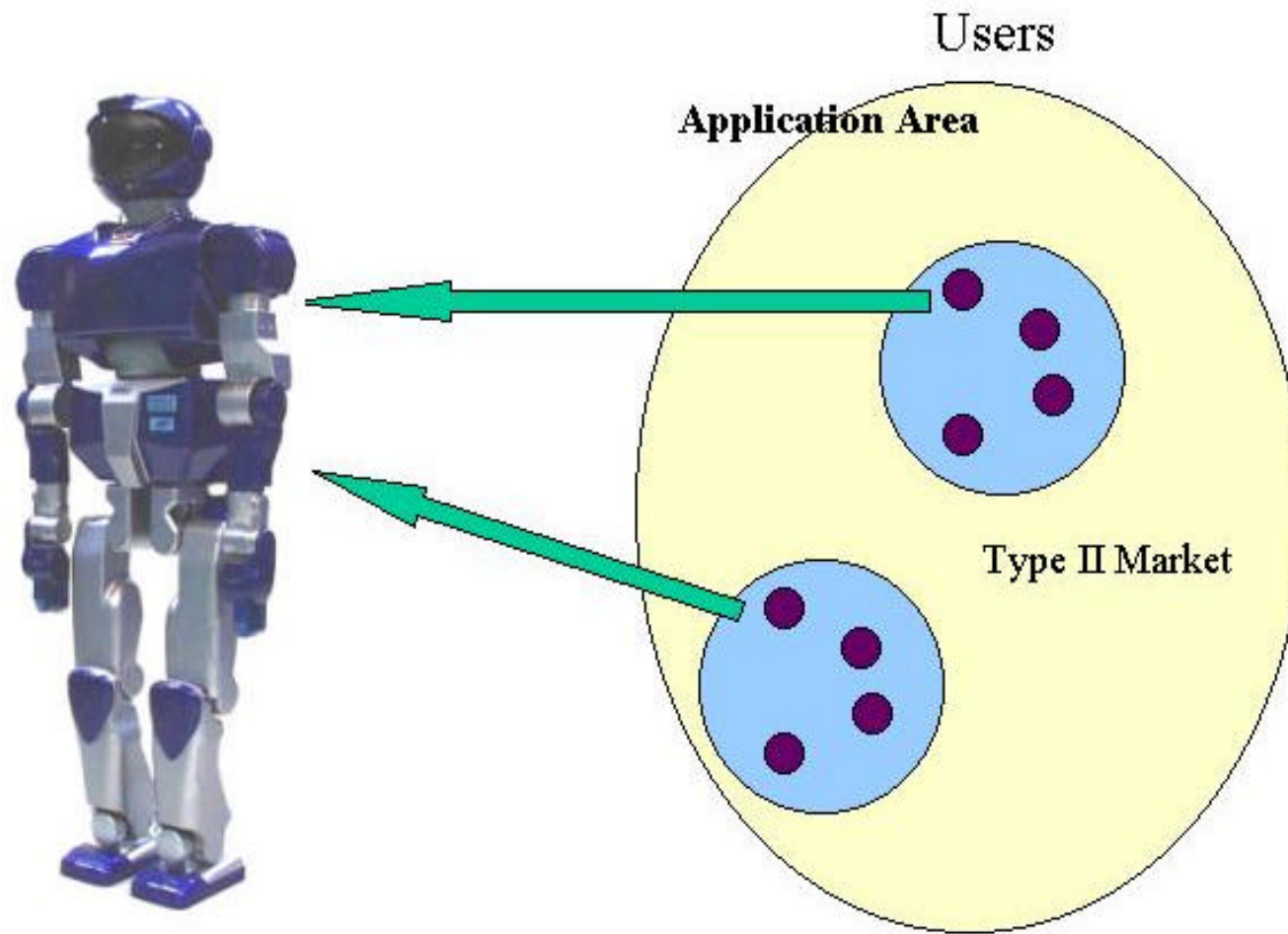
Type II Market

Helper for Elderly Persons
(heterogenous requests)

How Can We solve Type II Market Problems ?

- 1) Develop a multi-purpose robot**
- 2) Provide a custom-made robot according to user's order**

Humanoid may provide a solution as a multi-purpose robot



Humanoid



SDR-3X (SONY)



PINO(ZMP)



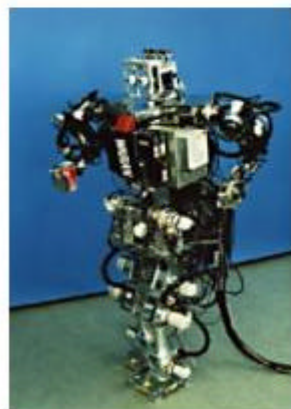
H7
(Univ. of Tokyo)



ASIMO (Honda)



HRP-2
(AIST/Kawada)

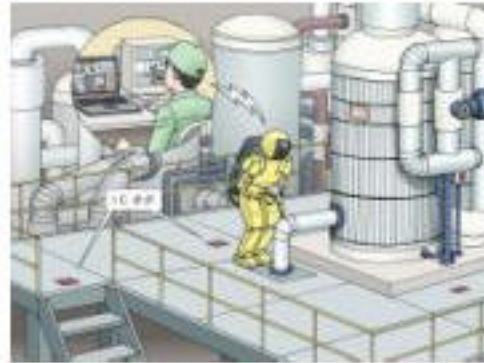


WABIAN
(Waseda Univ.)

Humanoid Robotics Project

- The objective of HRP is to develop a humanoid robot that can work with a human while sharing the common space.
- 5 years project from 1998FY to 2002FY
- The total budget is about 4.6 billion JPY.

Multi-Use Humanoid



Plant Maintenance



Home Security Service



Human Care

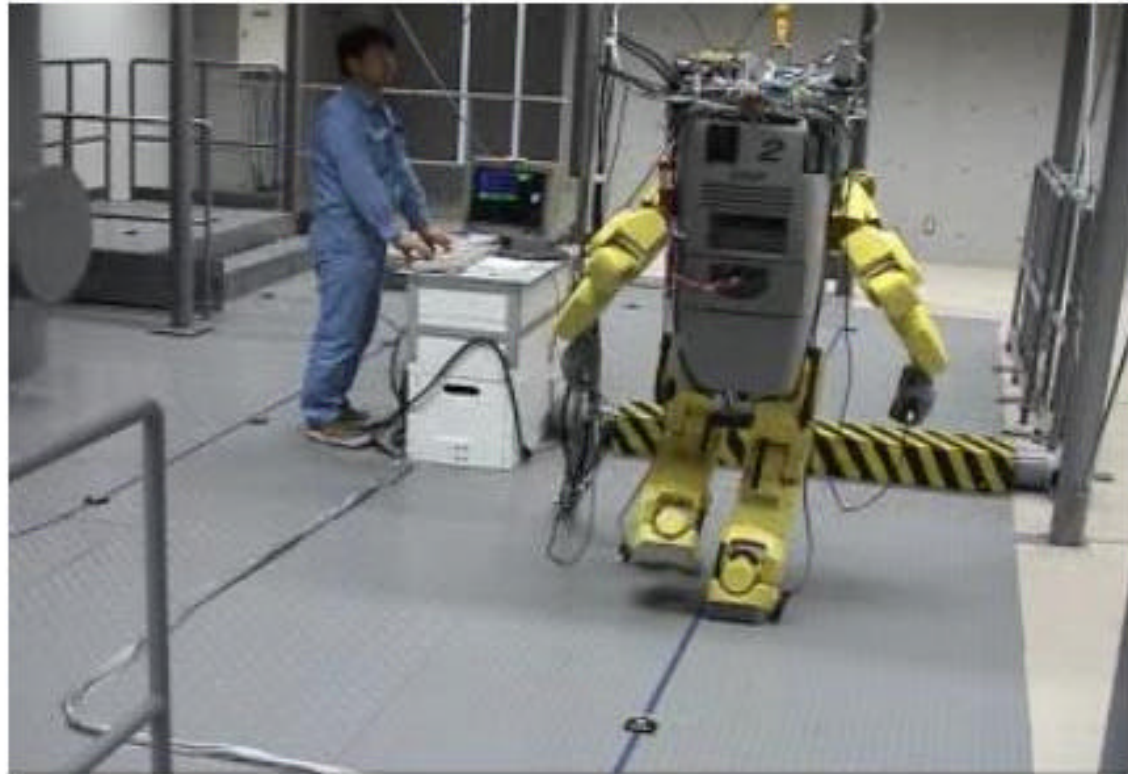


Machine Operation

AIST's Research Contributions in the Project

- Two Humanoid Platforms : HRP-1S and HRP-2 (& HRP-2P) which have Open Controller Architecture
- Fundamental Functions: Move on Rough Surface, Safe Fall Over and Stand-up etc.
- Application tasks: Human-Robot Cooperative Manipulation, Driving a Backhoe

Plant Maintenance



Mitsubishi Heavy Industry

Developed Humanoid (HRP-2P)



Specifications

Dimensions	Height	1,540 [mm]
	Width	600 [mm]
	Depth	340 [mm]
Weight <i>inc. batteries</i>		58 [kg]
D.O.F.		Total 30 D.O.F.
Head		2 D.O.F.
Arm		2 Arms × 6 D.O.F.
Hand		2 Hands × 1 D.O.F.
Waist		2 D.O.F.
Leg		2 Legs × 6 D.O.F.
Walking Speed		up to 2.0 [km/h]

Humanoid Platform HRP-2



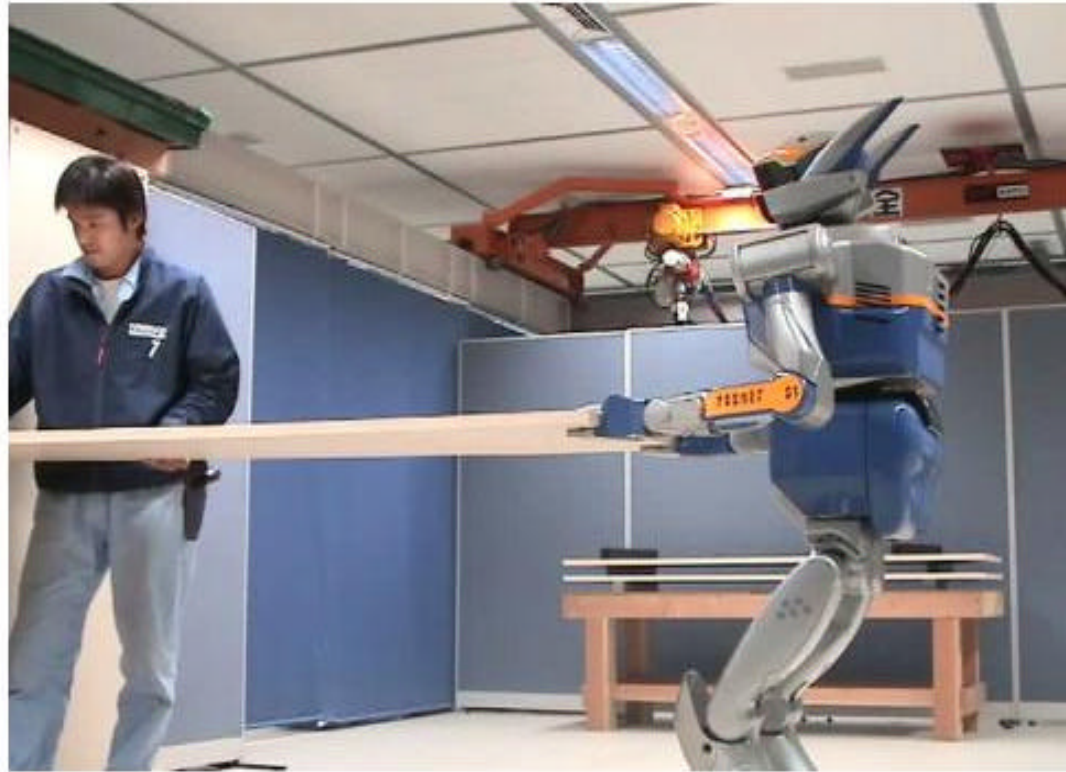
Safe Fall Over and Stand-up



Humanoid Platform HRP-2P



HRP-2 Works with a Human



Yasukawa, Shimzu, Kawada, AIST

HRP-2 commercially available



Specifications

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Kawada / General Robotix

How Can We solve Type II Market Problems ?

- 1) Develop a multi-purpose robot
- 2) **Provide a custom-made robot according to user's order**



How to encourage Custom-made Robotic Business ?

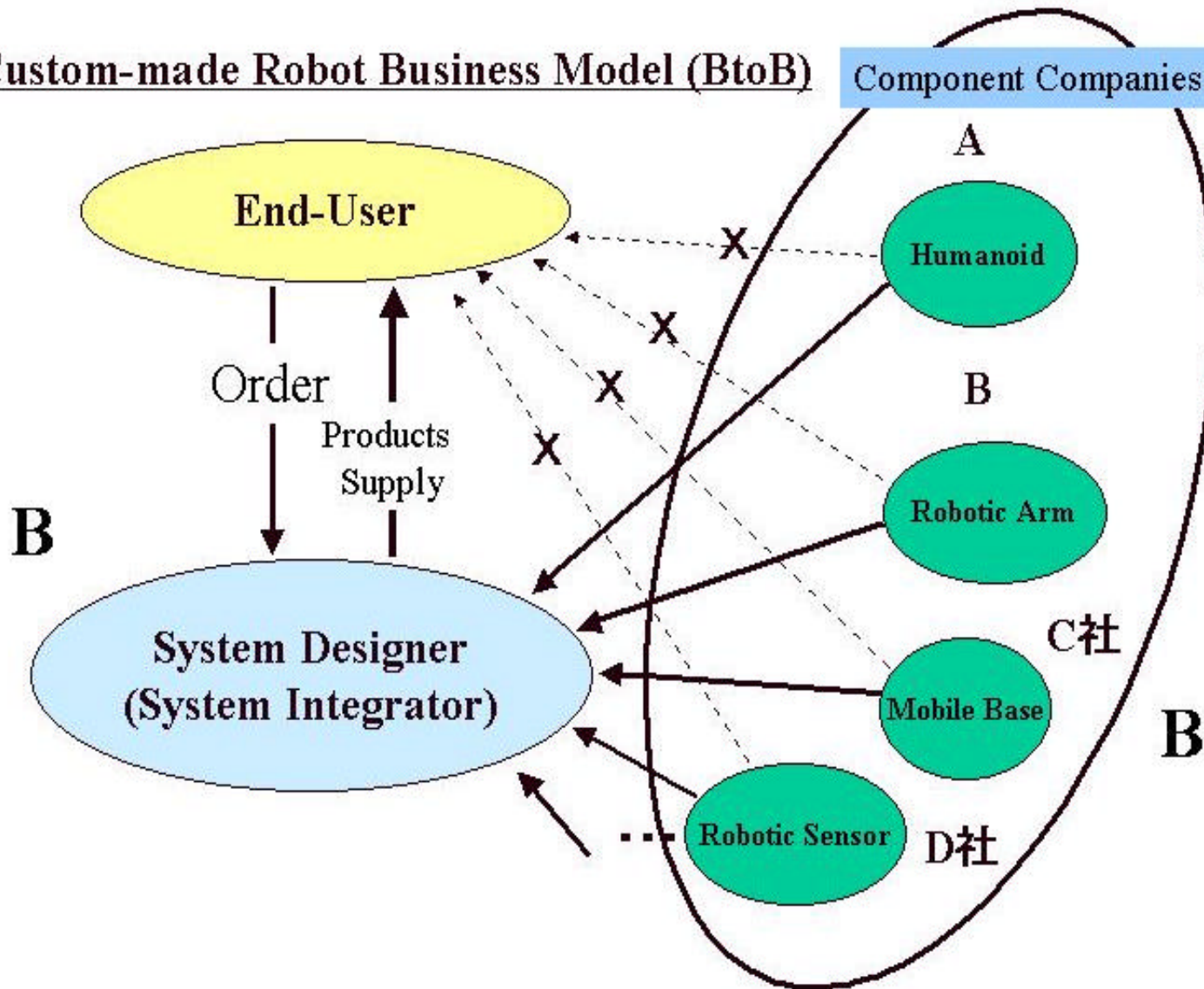
It will be important to supply efficient robotic components to the market with which **Robotic System Integrator** can design appropriate robots according to user's request with reasonable cost !!!!

Supplying Standardized component

Supplying components as a distributed object

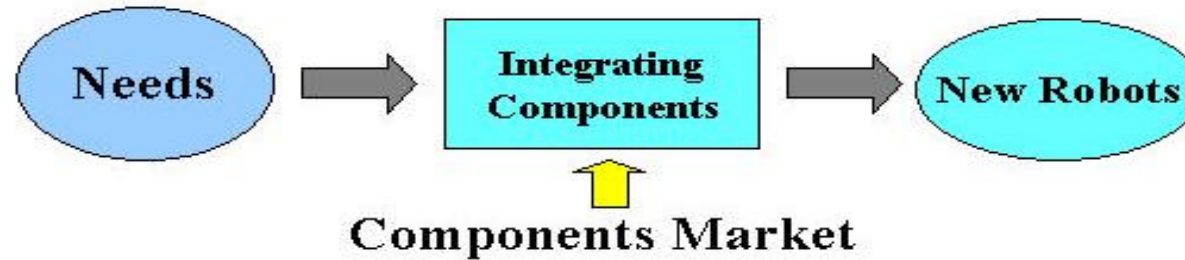
Custom-made Robot Business Model (BtoB)

Component Companies

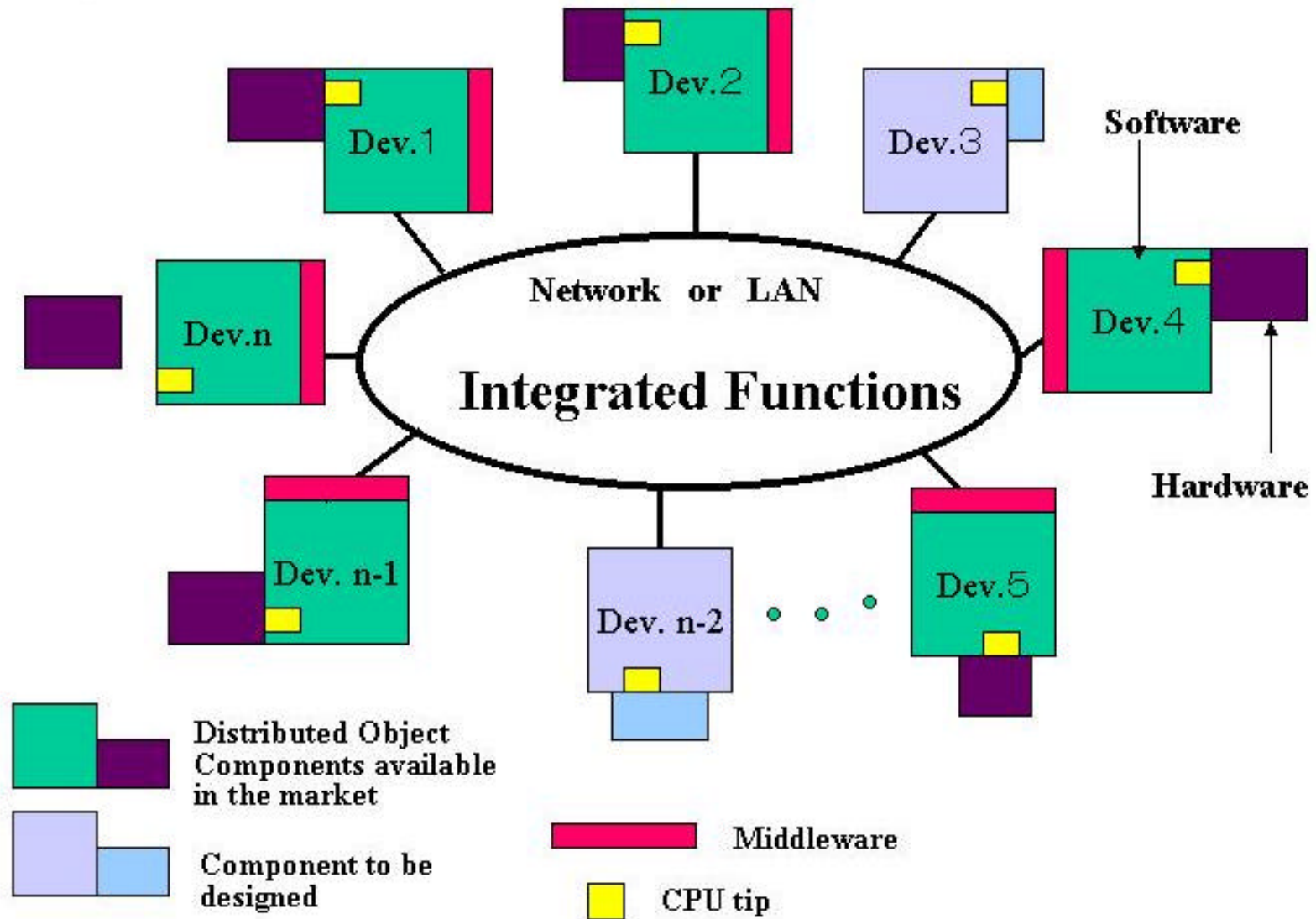


How new robotic products will be produced?

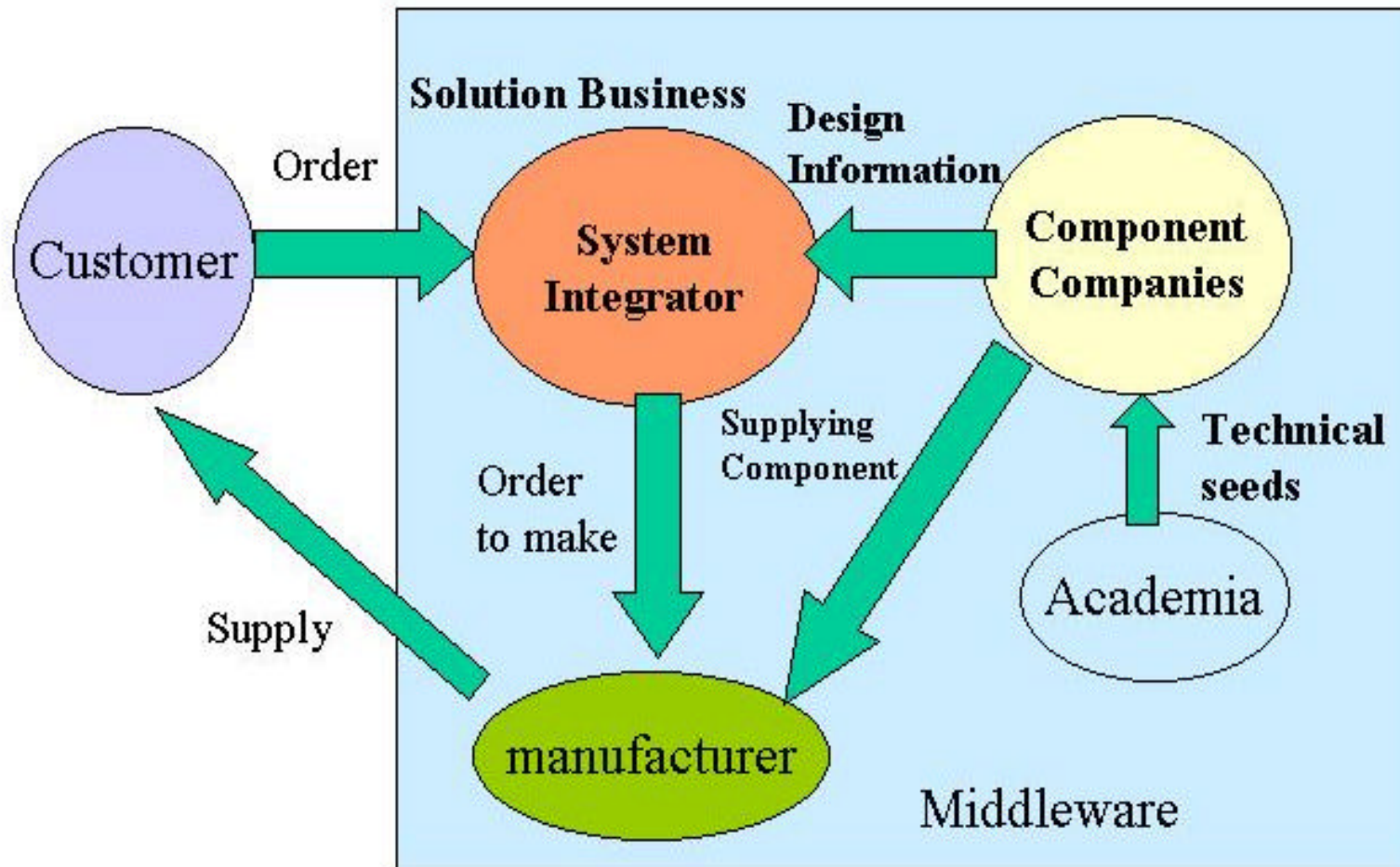
Heterogenous needs
(Custom-made business)



Design of Custom-made Robotic System



Expected Future Robotic Industry Business Model



Summary

- 1. Robotics needs new products concept to contribute to industry.**
- 2. There are two types of robotic Markets, Type I (ready-made robotics) and Type II (custom-made robotics).**
- 3. With the Market Type in mind, the technology should be prepared and also R & D should be organized.**