Future Solutions Project: Developing your Solution

FSE150 Future Solutions Project

Progress you've made

- Needs Assessment is COMPLETE
  - Customers & stakeholders
  - Customer needs
  - Opportunity for Innovation
  - Functional Requirements
  - Value Proposition
- Now you begin Brainstorming Solution Ideas

Engineers…

- Explore the world with **CURIOSITY** to find opportunities to create value
- Make **CONNECTIONS** between different people, information, and knowledge to develop solutions

CREATE VALUE for Society

Future Solutions Project

- Your Task: Develop a future solution to a problem/need in one of the Grand Challenge areas

- **Identify an Opportunity** to create added value for society
- **Develop a Solution** which you *imagine* may exist in the future
- Identify **current enabling technologies**
- Identify **key technology development milestones**
- Identify **potential social challenges** (moral, cultural, political, global, etc.)
- Describe the **societal benefits** (value created) and other **social impact** of your solution

Product Development

- Identify a problem
- Determine Customer Needs
- Define Functional Requirements (what the product has to do)
- **Develop solution(s) to meet Needs & Requirements**

Begin Designing a Solution

- Start imagining your solution
- How will your solution fulfill the needs/requirements and create value?
- What Technologies will you use?

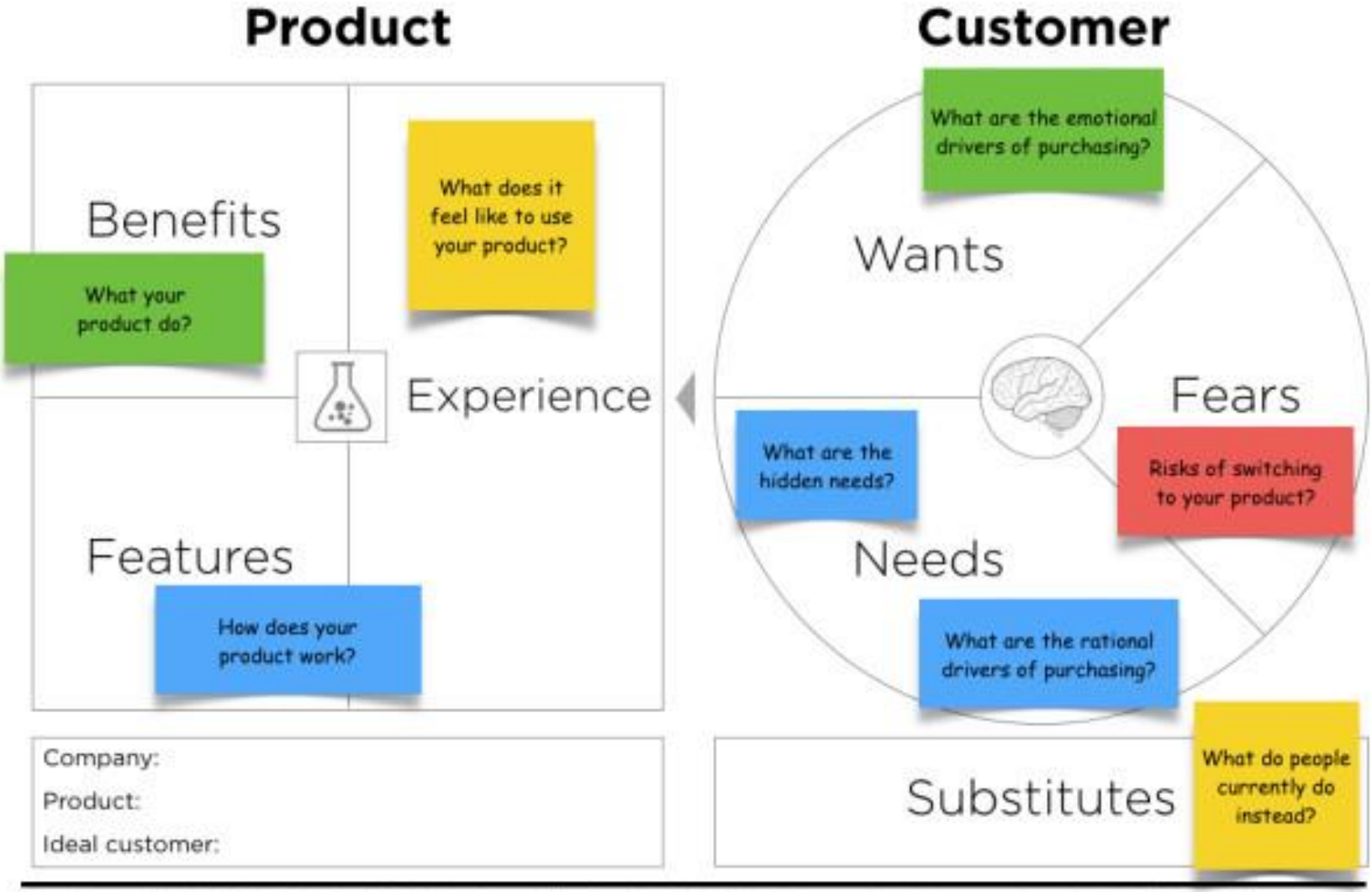
REMEMBER:

Use customer needs to drive your design

CUSTOMER NEEDS → DESIGN FEATURES

Value Proposition Canvas

Value Proposition Canvas



Once you have some ideas…Think about the important details…

- **How will your solution accomplish your goals? (Form, Function, key features)**

- **What Technologies will you use?**

Step 1: Review Requirements

What does your ‘product’ need to do?

- Review Functional Requirements
- Be quantitative (if/when possible)

Step 2: Identify Technology needed for solution to meet requirements

How will your solution meet those goals?

- Identify Technologies & Knowledge required
  - Current enabling technologies (As is OR Develop further)
  - New Technologies (that don't exist yet)
  - Scientific Principles & Knowledge

Enabling Technologies

- What technologies are currently under development (in research) or commercially available that may contribute to the development of your solution?
  - Find specific technologies (cite sources!)
  - May not have the exact capabilities you need…

Examples (Previous Future Solutions Project)

- “Recollection” (chip implant under the skull that allows memory manipulation)

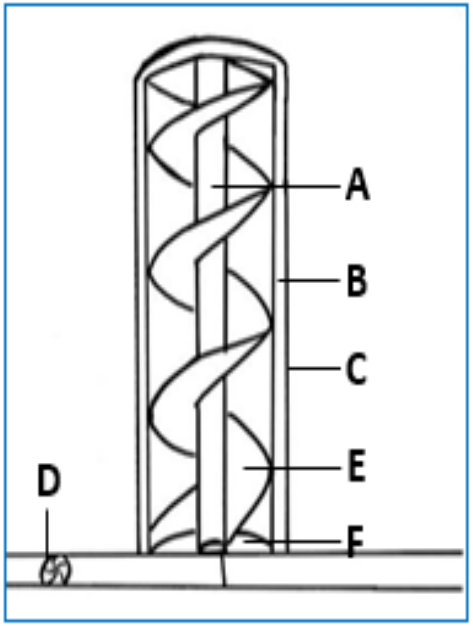
- Enabling Technologies: battery technology, wireless communication technologies, nanoscale electronics, brain-computer interface, EEG, advanced polymers and coatings, quantum computing, etc..

Examples (Previous Future Solutions Project)

- Sustainable Greenhouse Towers

Components

- A: Inner pipe moves runoff up the tower
- B: Clean water drains to outside pipe
- C: Nano solar cells to power[1] [5]
- D: Centrifugal water pump [8]
- E: Inner spiral: Filtering crops [4], Hydroponics [10]
- F: Biofilter to remove remaining contaminants [4]



- Examples of enabling technologies:
  - Centrifugal water pump, high efficient transparent solar cells, carbon fiber materials, hydroponics, genetically engineered plants, genetically engineered bacteria, etc.

Step 3: Identify Development milestones (the 'road map')

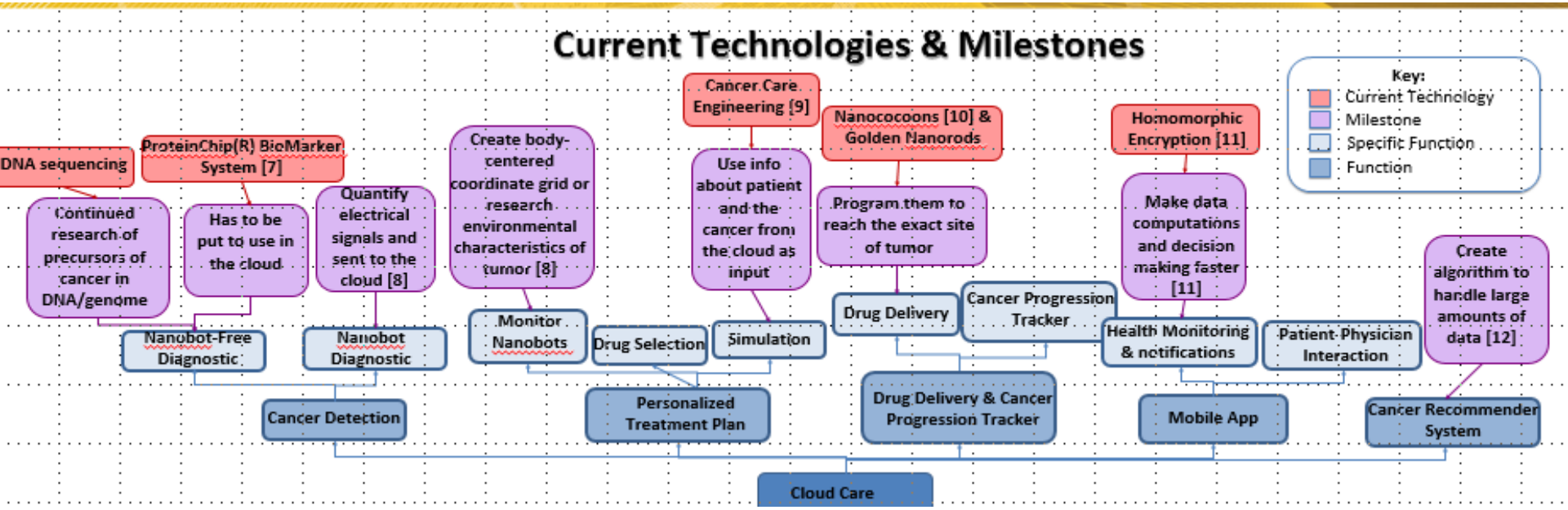
How will we get from Here (Now, current tech) to There (Future, your solution)

- What future technological advancements or development is needed?
- May be helpful to create a Diagram to visualize

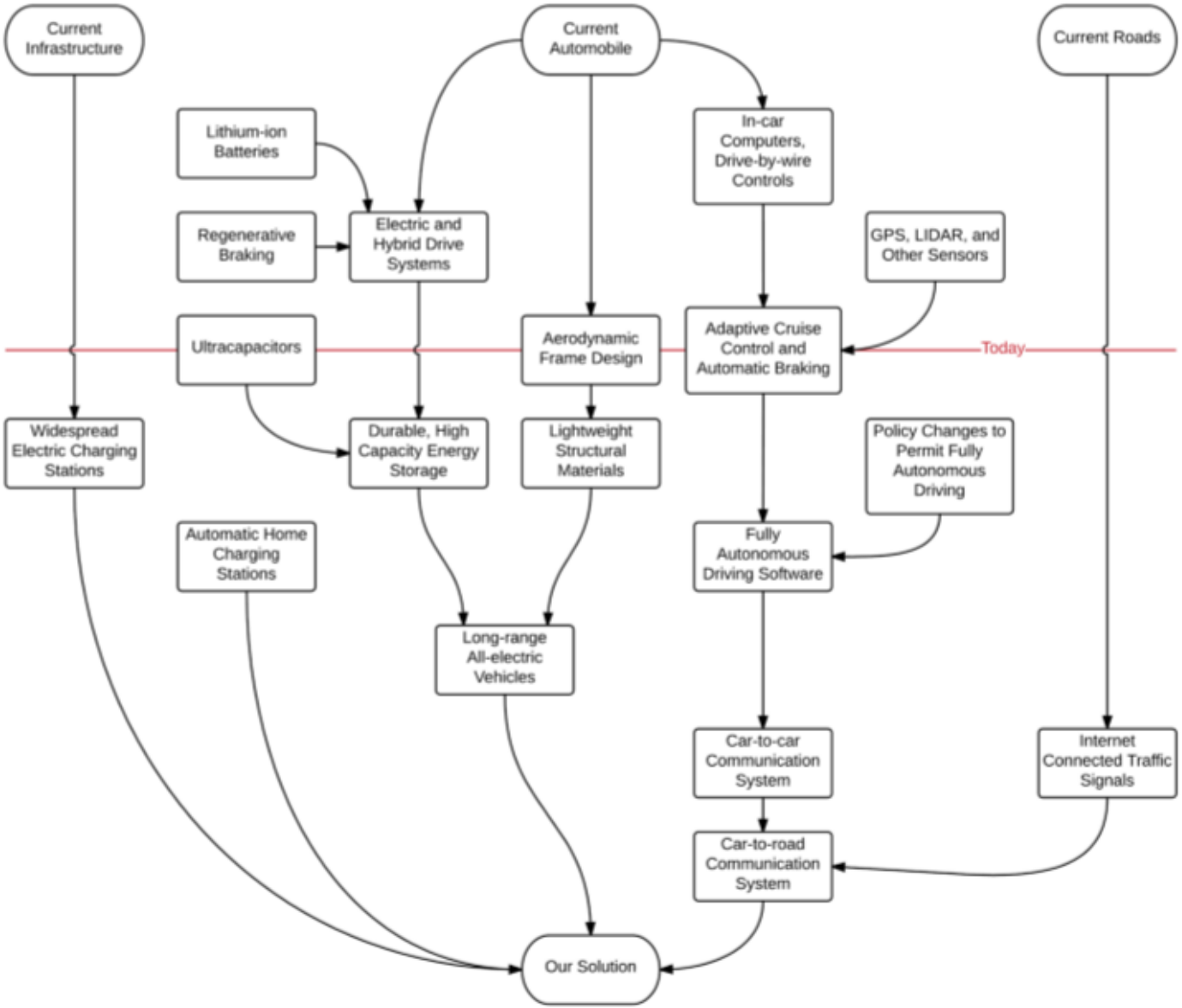
Development Milestones

- What is the ‘gap’ between current ‘enabling technologies’ and the technologies required for your solution?
- What advancements, combinations of technology, and/or development of new technology need to be made in the future to fill that ‘gap’?

Current Technologies & Milestones



Technology Development

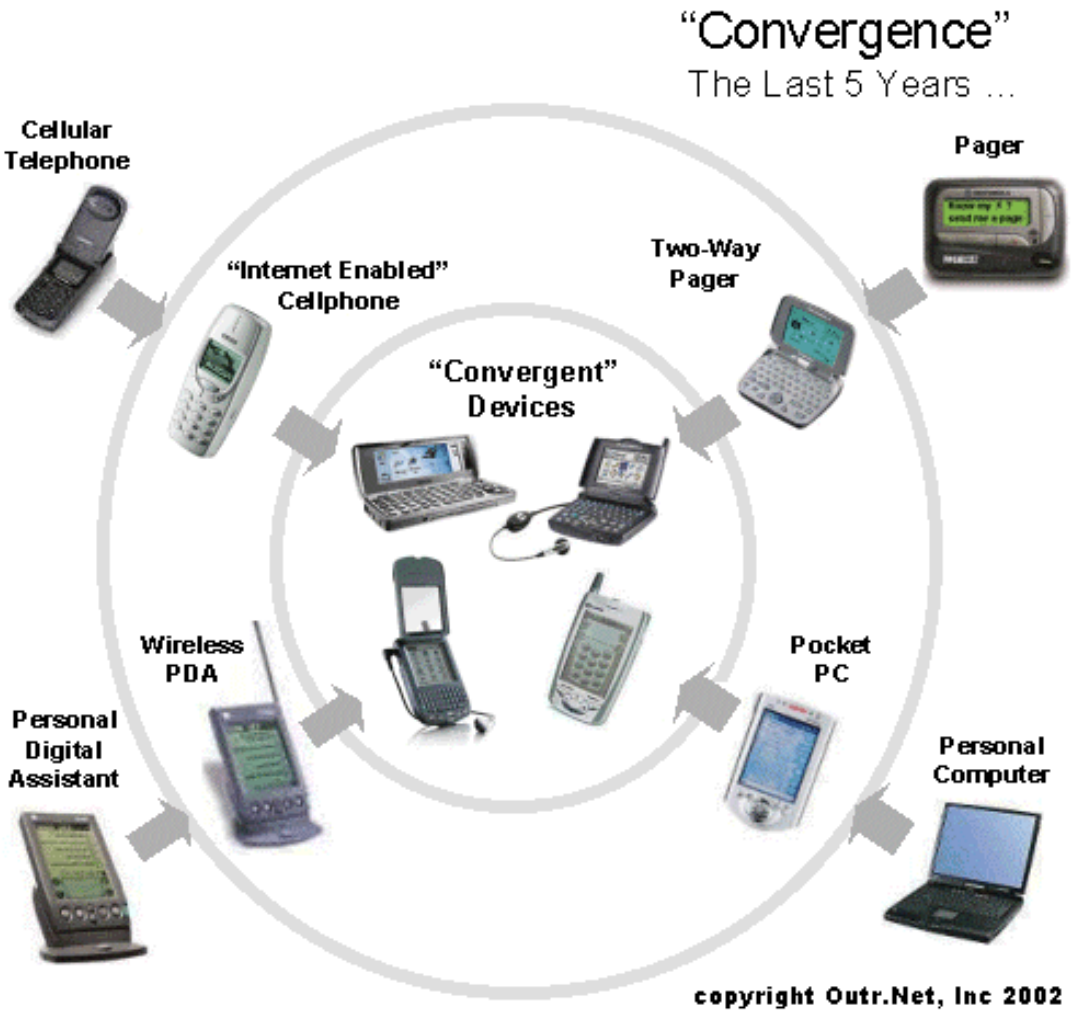


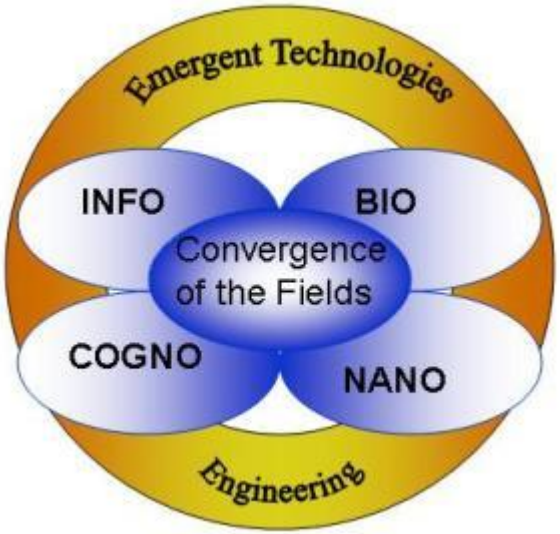
Today's Goals

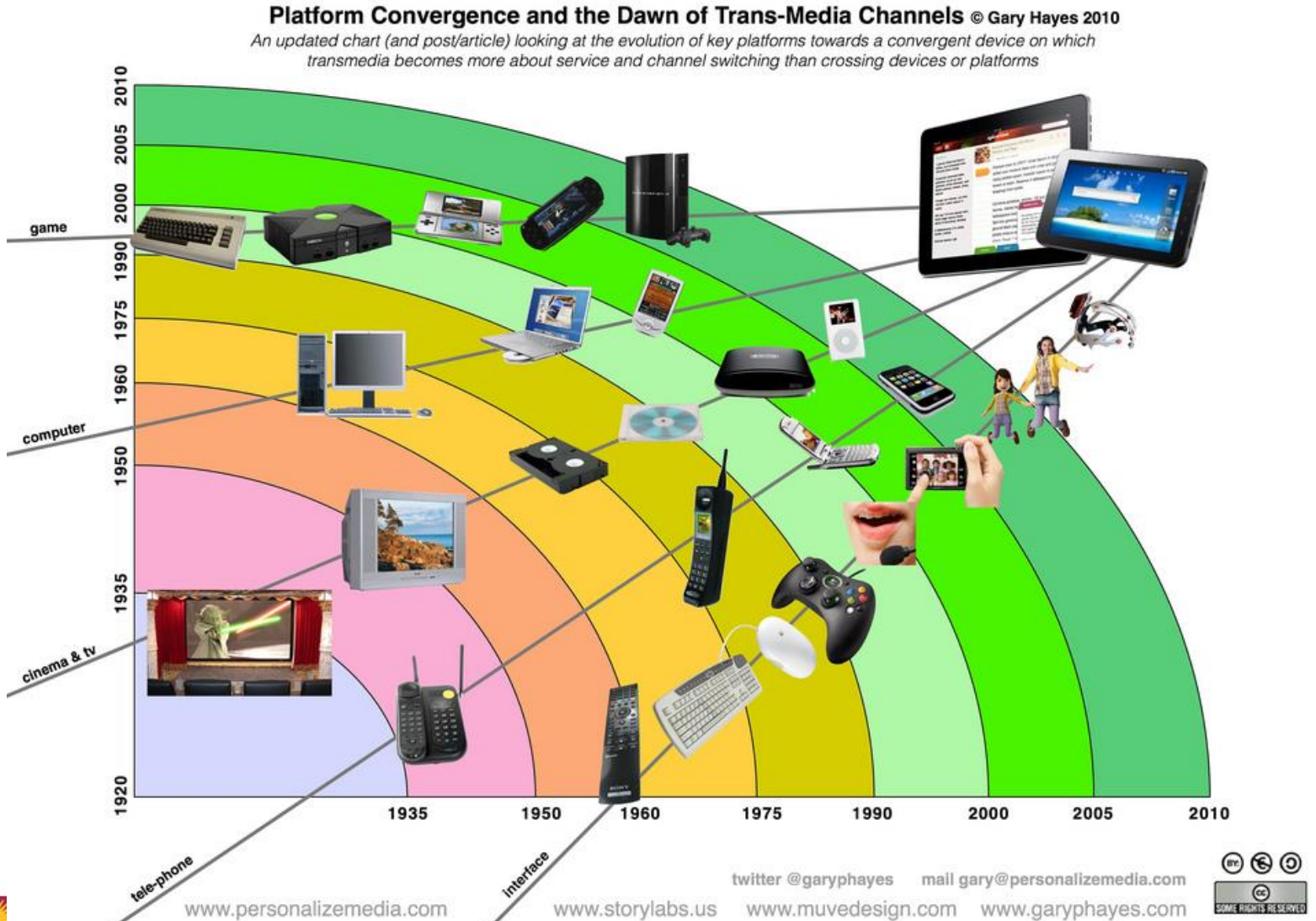
- Begin Imagining possible design solution(s)
  - Think about Form, function (pictures & words)
  - Create Design features to satisfy customer needs
- Think about **HOW** your solution will work
  - Identify technologies, knowledge, etc. that are required for your solution
  - Find currently available 'enabling' technologies for your solution (in research, or on the market)

ADDITIONAL EXAMPLES OF VISUALS (FOR INSPIRATION)

Examples


"Convergence"
The Last 5 Years ...
Cellular Telephone
"Internet Enabled" Cellphone
Pager
Two-Way Pager
"Convergent" Devices
Wireless PDA
Pocket PC
Personal Digital Assistant
Personal Computer
copyright Outr.Net, Inc 2002


Emergent Technologies
INFO
BIO
Convergence of the Fields
COGNO
NANO
Engineering



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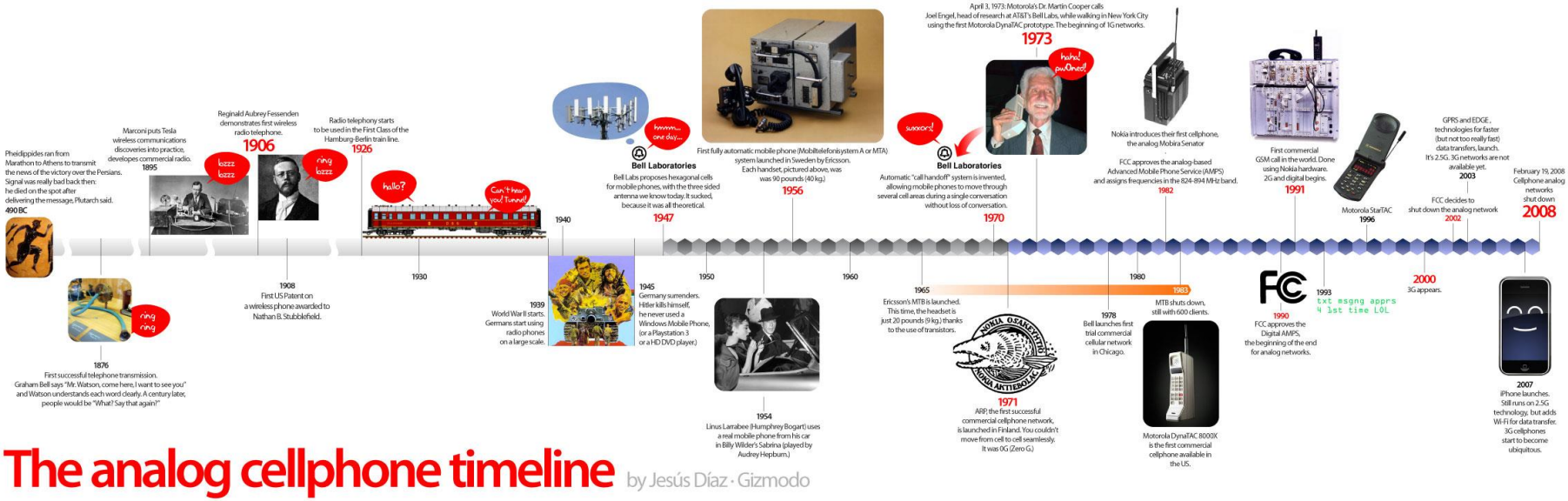
http://evolutionofcomputers.edublogs.org/files/2011/11/computer-timeline-18x44jx.gif



The analog cellphone timeline

by Jesús Díaz · Gizmodo

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http://jerrykang.net/wp-content/blogs.dir/1/files//2011/10/cache_lh_-Cellphones-Timeline3.jpg

Visual History of MEMS

Kulite Started to specialize in piezoresistive silicon (Joe Mellon) 1959

HP Micromachined Ink jet nozzle 1979

Honeywell Fairchild Starts sensor products 1960s

Internet Concept 1962

Silicon transistor invented, 1947

Integrated circuit, Kilby TI, R. Noyce 1959

National Semiconductor Starts 1973

TI DLP research started 1977

NovaSensor Founded Janusz Brezyk Kurt Petersen Joe Malon 1985

Analog Devices Starts accelerometer effort, 1987

ADI ships products to Saab, 1993 50K units

MEMS Bubbles

Optical MEMS Smell sensor Biochemical sensor

Nintendo Wii Nov 2006

Richie Payne resigns, 1997

Bosch DRIE invented 1994

iPod First Shiped 2001

iPhone First Announced 2007

iPad 2010

1970

1980

1990

2000

2010

Piezo-resistive effect in silicon discovered\ C. Smith, 1954

Surface micromachined resonant gate transistor Harvey Nathanson 1967

Electrostatic Surface Micromotor Tai, Fan, Muller 1988

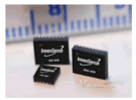
MicroTas concept paper by Menz et al 1990

TI DLP product 1994

MEMSIC IPO, 2007

Cepheid IPO July 2000 &6/share

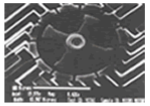
InvenSense Founded 2003



InvenSense $100M revenue 2010

Anisotropic silicon etching 1962 PJ Holmes

LIGA Process 1982



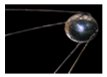
E-Ink 1997

UIUC Mosaic Browser 1993

DRIE Process Invented at Bosch 1994

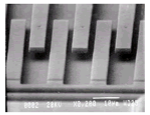
$16 billion optical MEMS "bubble" 1998-2003

Knowles billion shipment 2009



Sputnik 1957

James Angell Starts pressure sensor at Stanford 1969



Silicon surface micromaching R. Howe and R. Muller 1982

"MEMS" name coined US DARPA MEMS Program Started Ken Gabriel 1992

XeF2 Etch for MEMS first used at UCLA 1995

Let a 1000 MEMS Companies Bloom

Siimple Pixtronics SiTimes ...

Qualcomm MEMS following Etalon begins 2004

Kurt Petersen "Silicon as a Mechanical Material" published 1982

BuckyBall Developed 1985 Smalley

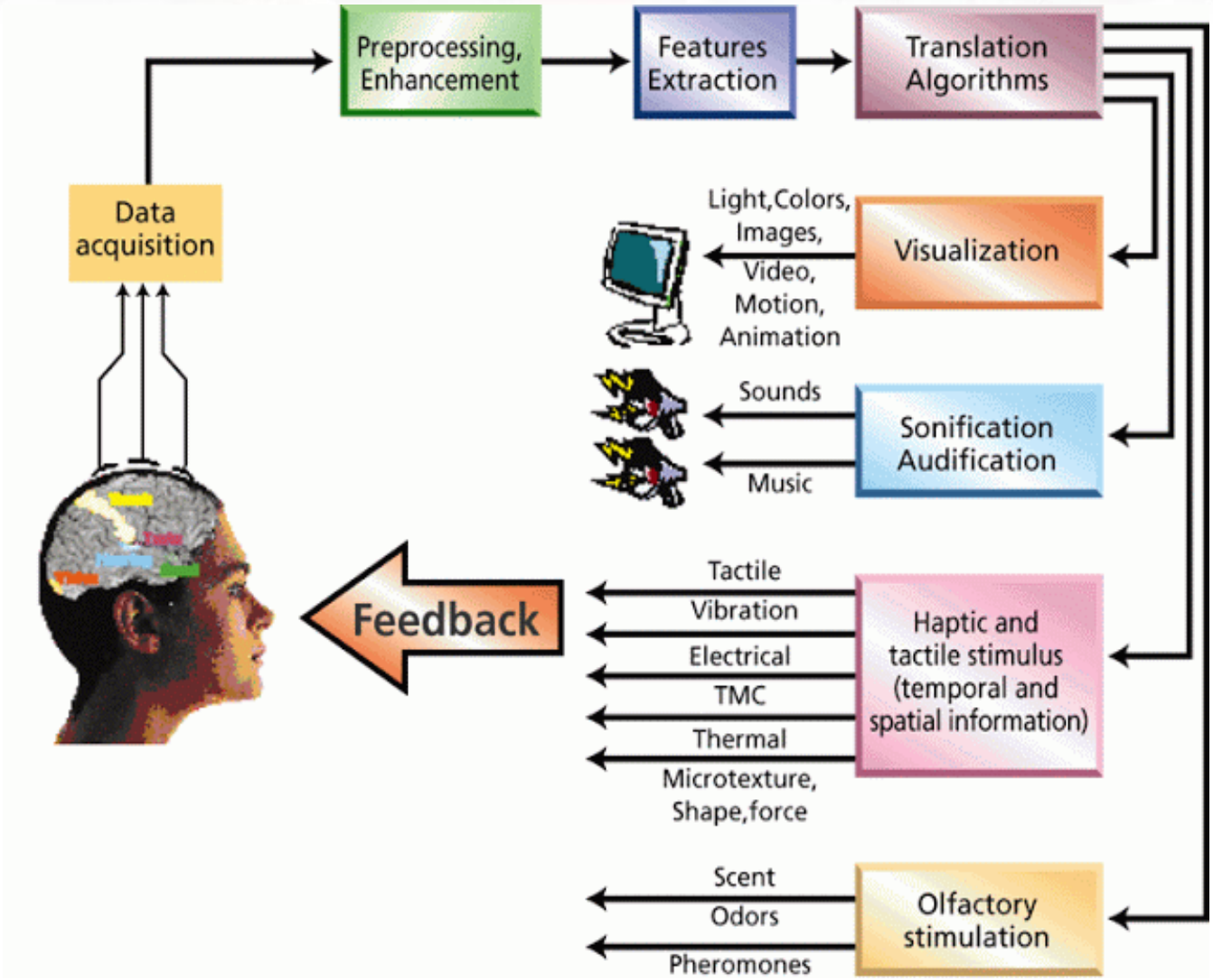
Clinton Announced NNI Nano Initiative 2000 Worldwide Nano Boom Starts

Feynman "Plenty of room at the bottom" 1959

Motorola Cellular Phone Demo 1973

visit memscentral.com

http://memscentral.com/images/graphic-history-of-mems-small.gifhttp



http://memscentral.com/images/graphic-history-of-mems-small.gifhttp://alfin2100.blogspot.com/2011/11/we-are-all-cyborgs-now-getting-to.html