



State of Technology: ICTs

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Fall 2007

Carnegie Mellon



Broader goals for ICT: Sustainable Development

- **WSIS and other efforts have talked of ICTD**
 - Scholarly efforts are also growing, e.g., IEEE's ICTD2006, 2007, etc.
- Whole range of technical, social, economic, and policy challenges related to “e-buzzwords” (e-learning, e-health, e-commerce, etc.)

Infrastructure Development

Basic Human Needs and Development

Economic Development

Empowerment

S Advanced Urban Transport **DB/IS**
CTRL **C**

S Disaster / Weather Forecasting and Warning **DB/IS**
CTRL **HCI** **C**

Distance and e-Learning **DB/IS**
HCI **C**

S Electricity Theft Reduction **DB/IS**
CTRL **C**

S Health Monitoring and Epidemiology **DB/IS**
HCI **C**

Agricultural Price Discovery **DB/IS**
HCI **C**

E-Governance **DB/IS**
HCI **C**

S Electricity Load Management **DB/IS**
CTRL **HCI** **C**

S Remote Medical Detection / Diagnosis **DB/IS**
HCI **C**

Expanding Markets for Rural / Traditional Goods **DB/IS**
HCI **C**

National and Global Inclusiveness **DB/IS**
HCI **C**

S Water Management **DB/IS**
CTRL **C**

S Drip and Advanced Irrigation **DB/IS**
CTRL **C**

Digital Libraries **DB/IS**
HCI **C**

Enabling ICT

Sensors, **C**ommunication, **DB/IS** Databases/Information Systems (**DB/IS**),
CTRL Controllers/Actuators/Effectors (**CTRL**), **HCI** Human-Computer Interaction (**HCI**)

Incorporates issues of: OS, Protocols, Robustness, Software, Hardware, Power Management, Regulation, Security, etc.

Source: Tongia et al. (2005)



Trends in Software Applications for Development

Joe Mertz
Fall 2007

Carnegie Mellon



Some software application trends for development

- Email
- Local area network
- Microsoft Excel

Somewhat mundane, no?

Development \sim = Business

- On the ground, development is the business activity of individuals, NGOs, local businesses, government agencies, and schools
- In many ways, development contexts are similar to business contexts
 - Gather information - E.g. AIDS patient history
 - Manage information - E.g. crop yields across years
 - Communicate - E.g. market prices to fishermen
 - Provide services - E.g. public health inspections
 - Produce Products - E.g. clean water

Improving business processes

- ICT investment improves development work in the same ways that it has for business.
- Organizations working in developing communities are adopting ICT the same way you have seen it used in offices, retail outlets, or government offices anywhere.

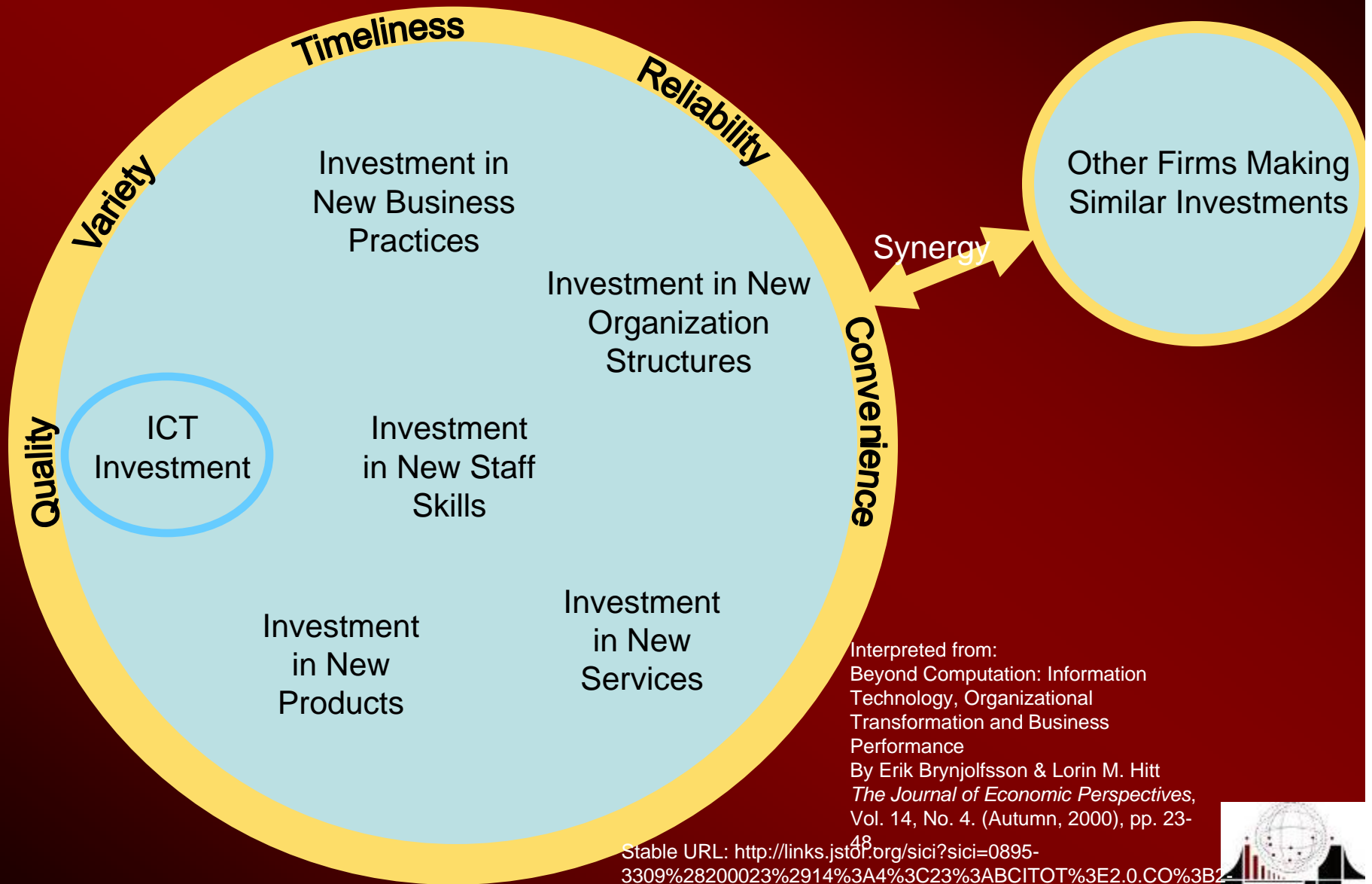
Software application trends

- Computers
- Printers, etc.
- Local area networks
- Internet connectivity
- Office applications
- Microsoft Outlook
- Simple Microsoft Access databases
- Web browser
- Email
- Local file sharing

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- But the value of ICT investment far outstrips the hardware and software investment

Value of ICT investment



Interpreted from:
Beyond Computation: Information
Technology, Organizational
Transformation and Business
Performance
By Erik Brynjolfsson & Lorin M. Hitt
The Journal of Economic Perspectives,
Vol. 14, No. 4. (Autumn, 2000), pp. 23-

Stable URL: <http://links.jstor.org/sici?sici=0895-3309%28200023%2914%3A4%3C23%3ABCITOT%3E2.0.CO%3B2>



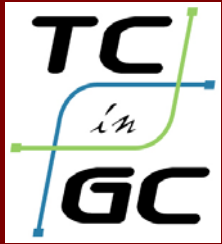
Examples...

- From Carnegie Mellon students

Jon

- Helped TLC-USA build a PHP/MySQL backed web site to raise funds to support an orphanage in South Africa.
- ICT investment created
 - New service opportunity
 - New convenience





Gopal & Steve: Palau

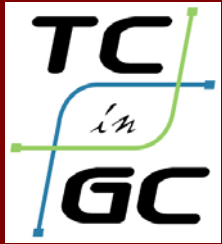
Patient tracking databases customized to the needs of individual hospital departments

General spreadsheet and database training sessions for physicians who make regular statistical reports but spend much time manually counting data.



Director of Ancillary Services, 12 months later:

- Department heads come to meetings with data.
- Decisions are made based on information, not conjecture



Matt – Palau

Matt helped the Ministry of Education implement open-source server software and expand staff skills.

Director of IT, 24 months later: has resulted in cost savings of \$50K per year.



Palau Ministry of Education boat

Web 2.0 applications

- *Web 2.0* applications are another trend
- *Web 2.0* is a quite fuzzy term
- It generally refers to
 - Internet-based applications
 - Often facilitating many-to-many communication
 - Often involving “social networking,”
 - whether in whole (e.g. MySpace)
 - or part (e.g. Amazon.com user reviews)

Content Management Systems

- Are a class of software applications that drive the interactivity of *Web 2.0* sites.

Types of CMSs

- Portals
- Blogs
- E-commerce shopping carts
- Intranets / Groupware
- Discussion boards
- Guestbooks
- Mailing lists
- Wikis
- Image galleries
- Video galleries
- Calendars
- Customer relationship management (CRM)
- Document workflow management
- Polls and surveys
- Project management

Student-facilitated examples

- For community development locally and abroad
- [These are not difficult to set up.]

Wireless Neighborhoods

- **Mission:** Use IT to enable communities to become competitive in education, human development, workforce development, health care and economic opportunity.
- **Membership organization needed to have**
 - An easy-to-maintain web site
 - Dynamically added content
 - Membership-only areas
- www.wireless-neighborhoods.org
- **Deployed by student consultant Spring 2005**
 - Used PLONE (FOSS)
- **Still in use, users adding content (slowly)**



Auberle

- Serves children and families through:
 - Foster care placement
 - Residence for children
 - Educational programs
- Wanted to support communication among their board of directors
- Deployed by student consultant Spring 2005
- Used eGroupWare (FOSS)

TriBoro Development Forum

- “An alliance representing the boroughs of Braddock, North Braddock, Rankin, and Swissvale to work together on issues common to all four communities.”
- Leaders in these four economically struggling Mon Valley communities meet regularly to work on common community development issues.
- They wanted a forum for sharing news, events, and other information.
- Deployed by a student consultant Spring 2007
- www.tbdfconnects.org
- Used DotNetNuke (FOSS)





State of Technology: Robotics

M. Bernardine Dias
Fall 2007

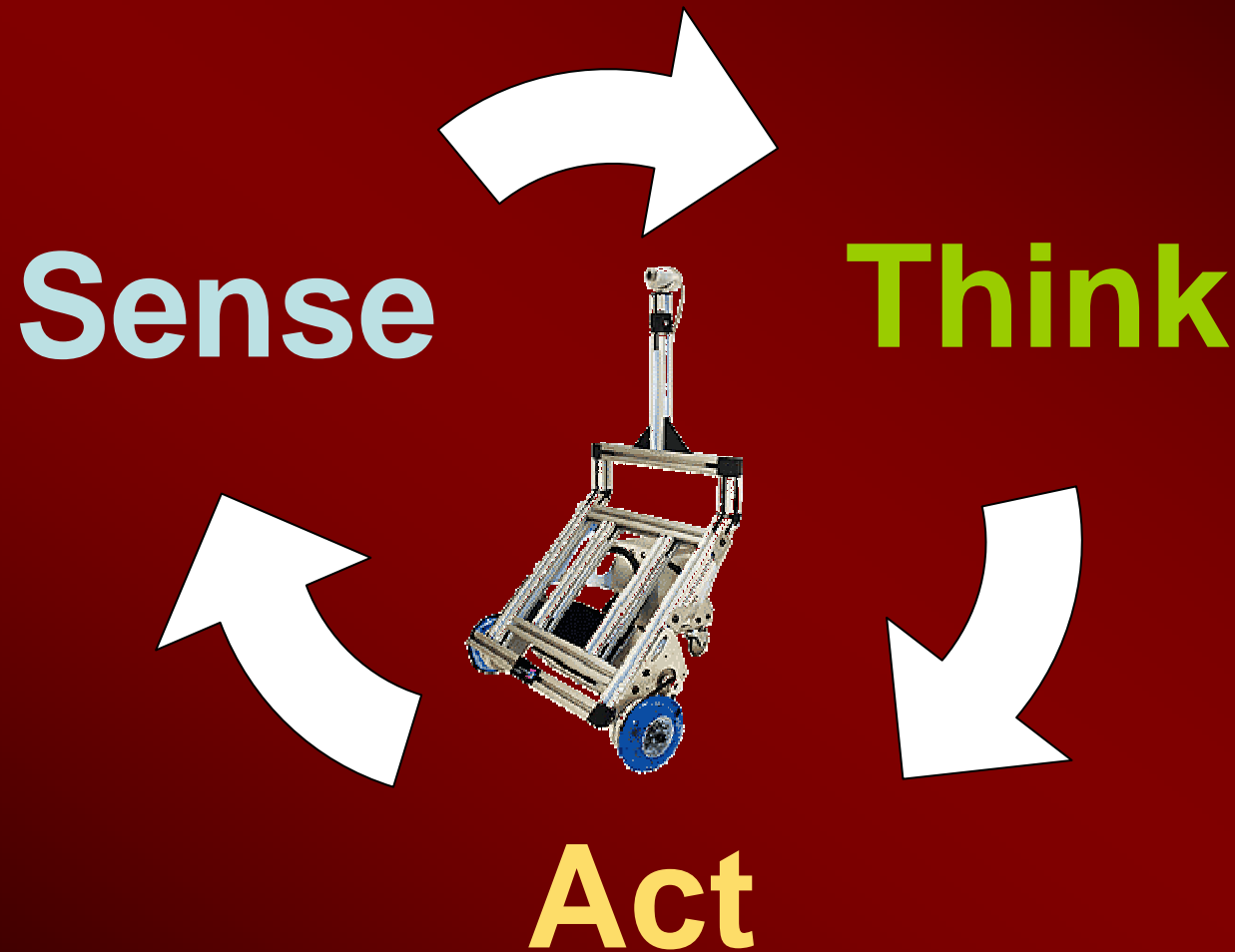
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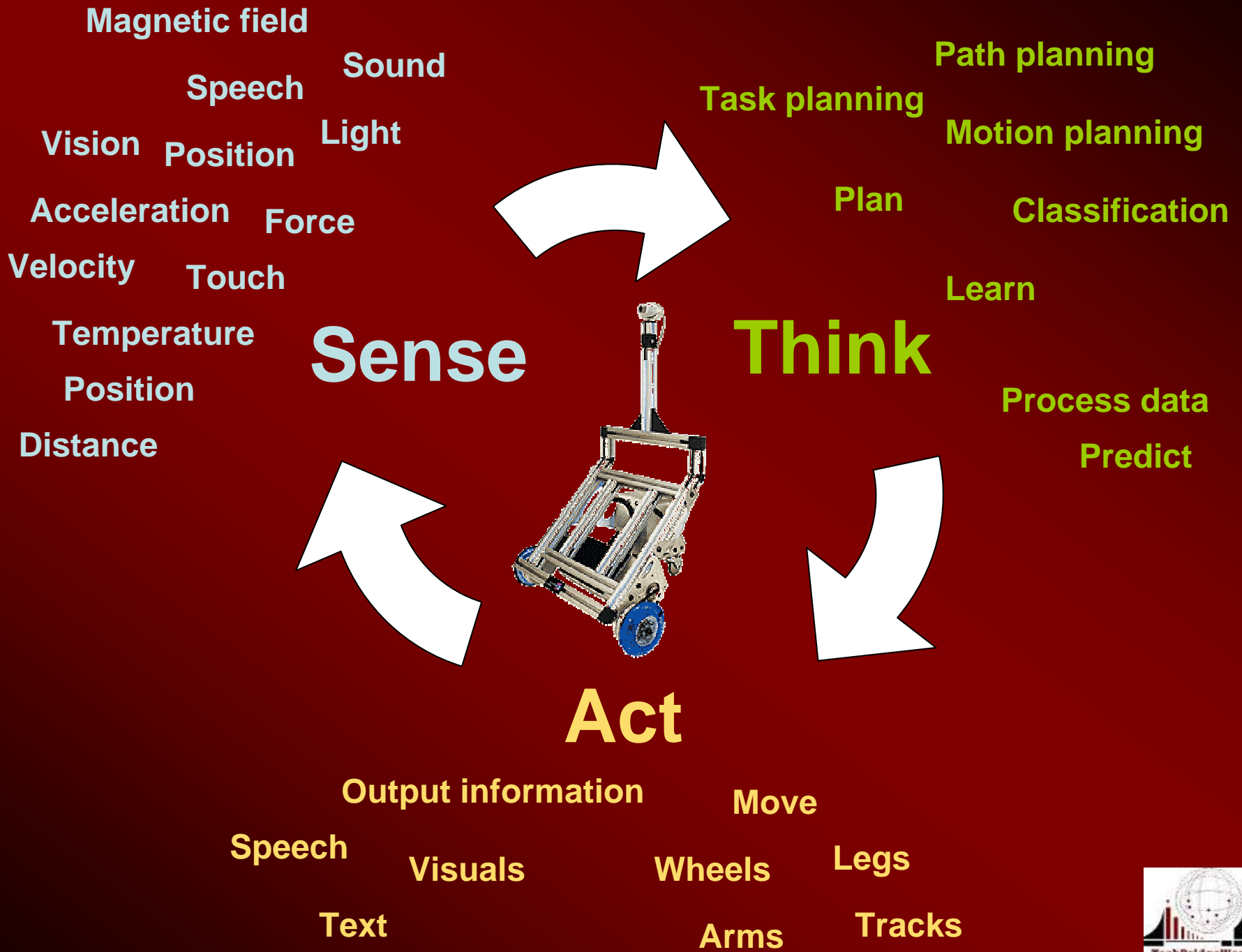


What is possible with technology today?

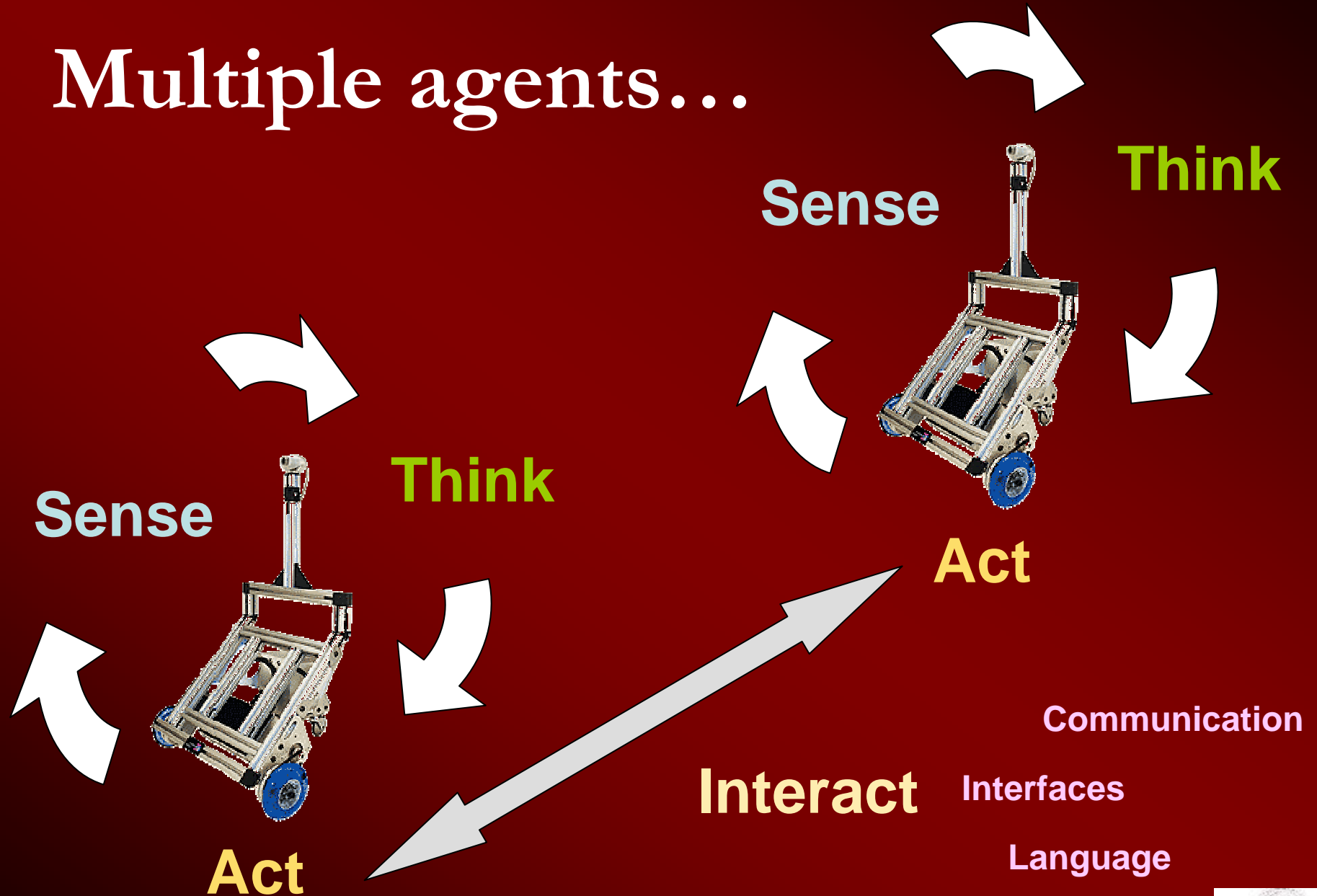
- Can't possibly be comprehensive
- New and exciting innovations are occurring each year
- Technology is permeating many parts of our lives today – sometimes in ways we don't realize...
- The purpose of this lecture is to present an overview of what technology can do today, and to inspire you to think *creatively* about what technology can do for underserved communities around the world

The Robot Control Loop





Multiple agents...



Interaction

- **Communication devices**
 - Phones/mobile phones
 - Internet (wired/wireless)
 - Radio
 - Television

- **Interfaces**
 - Graphical interfaces
 - Bar-code scanner-based interface
 - Audio interfaces for the blind
 - Multiple mice per computer

- **Languages**
 - Automated translation
 - Same Language Subtitling



Bumptop

<http://bumptop.com/>

Movie:

<http://www.ted.com/index.php/talks/view/id/131>

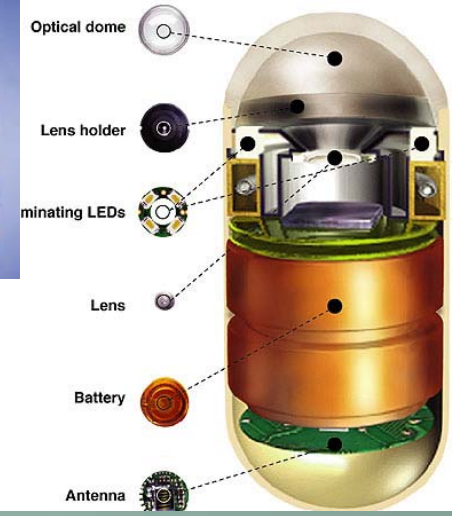
Perception

■ Sensors

- Cameras used in agricultural disease diagnosis
- Chemical sensors for identifying dangerous substances
- Sensor networks for soil/environmental monitoring

■ Intelligent perception systems

- Filtering and signal processing to identify objects of interest
- Inspection systems
- Sensor suites for activity monitoring



PillCam

[http://www.givenimaging.com/
Cultures/en-
US/Given/English/Products/ES
O_CE/](http://www.givenimaging.com/Cultures/en-US/Given/English/Products/ES_O_CE/)

Cognition

- Optimization
 - Optimizing use of limited resources
- Analysis
 - Analyzing complex data sets
- Modeling and Estimation
 - Modeling soil properties and estimating rain fall
- Learning and Prediction
 - Learning weather patterns and predicting disasters
- Guidance
 - Training programs of all kinds



BodyMedia activity monitor
<http://www.bodymedia.com/>

Action

- Manipulation (physical/data)
 - Remote surgery
 - Landmine disposal
- Transportation (physical/data)
 - Smart vehicles
- Mobile Manipulation (Mobipulation)
 - Rescue vehicles



SONY QRIO robot

Movie:

<http://www.youtube.com/watch?v=33a33XEVHKE&mode=related&search=>

Integrated Systems

Computer Vision



Planning

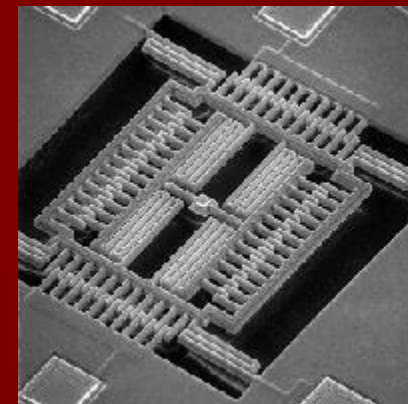
Multi-Agent Systems



Medical Robotics



Manufacturing



MEMS

What drives innovation?

- Profit (promise of)
- Driven/passionate individuals
- Needs
- Wars
- Disasters
- Grand challenges

Why Grand Challenges?

- Drive collaboration
- Build Technology
- Build Market

The New York Times
ON THE WEB

**Software Defeats
Chess Champion**



Impact of the Grand Challenge

- The “impossible” became “possible” within 2 years!
- Real outcomes
 - New sensing technology
 - New planning technology
 - Improved driver safety
 - Renewed focus on vehicle autonomy and intelligence



Robots in space!



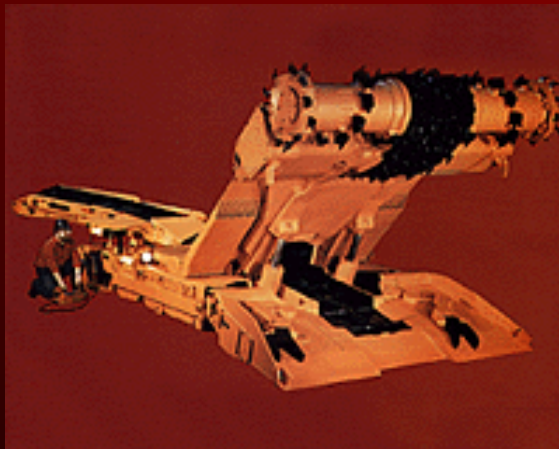
Military robots



Automated vehicles



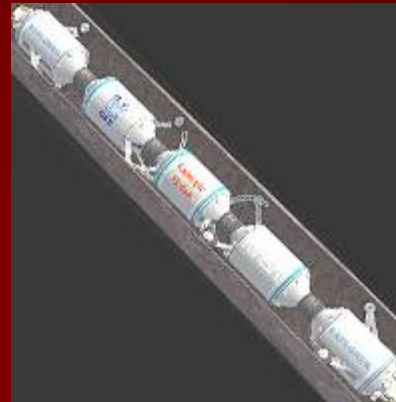
Automated tools



Exploring harsh environments



Industrial automation



Entertainment and education



Summary...

- Try not to limit your solution space to thirty-year-old technology solutions just because you are solving a problem in an underserved community
- Sometimes the best solution won't involve any form of technology, other times we will need to adapt or apply an existing technology solution, but sometimes we need new technology to solve a problem
- Encourage and engage in research relevant to underserved communities