Microsoft® Research

Faculty Summit 2010

Guarujá, Brasil | May 12 – 14 | In collaboration with FAPESP

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Microsoft Research: Ensuring Microsoft's Future

Henrique (Rico) Malvar
Distinguished Engineer, Microsoft Corporation, and
Managing Director, Microsoft Research, Redmond

Contents

- Motivation & MSR overview
- Technology transfer
- External collaborations and impact
- Examples of MSR technologies
- Q&A

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Complex ecosystem


desktop PC


laptop PC


media center PC


Xbox 360


MS Surface


IP phone


tablet PC


pocket PC

mobile phone


RoundTable


servers


portable media center

Zune


cable TV box


data centers

Web


dn.sapo.pt - Translator - Windows Internet Explorer
http://www.microsofttranslator.com/bv.aspx?ref=SERP&br=ro&mkt=en-US&dl=en&lp=pt_en&a=http%3a%2f%2fdn.sapo.pt%2f
diario de noticias
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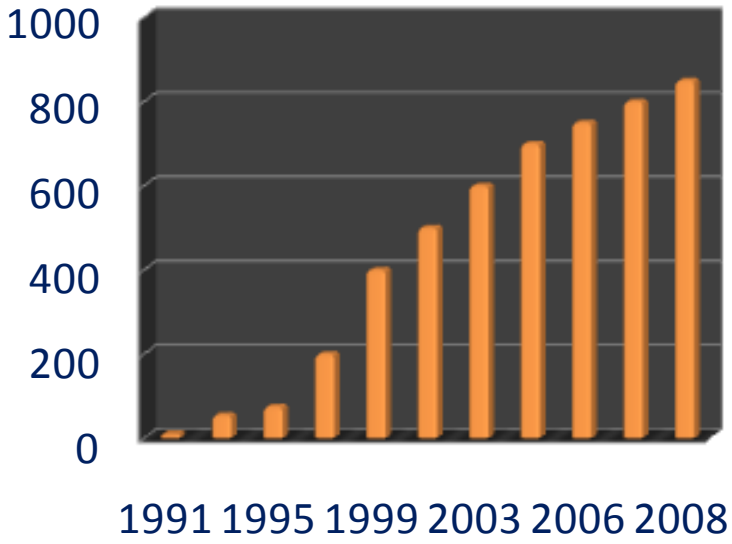
Translated: 100%
Go to original page
sapo.pt Acesso Blogs Fotos Mail Messenger Spot Videos
Descubra as Soluções de Financiamento Cetelem.
RSS Última hora Arquivado caso contra polícia por "sexo virtual"...
Diário de Notícias
INÍCIO DESPORTO CARTAZ BOLSA GENTE ESPECIAIS GALERIAS ARQUIVO
Portugal Globo Economia Ciência Artes TV & Media Opinião Pessoas
IRAQUE: DUPLO ATENTADO
Novo balanço aponta para 132 mortos e 520 feridos
Hoje
As autoridades iraquianas informaram que subiu para 132 o número de mortos no duplo atentado ocorrido hoje no centro de Bagdad, o mais sangrento do ano, que provocou ainda 520 feridos.
Atentados mais graves desde a queda de Saddam Hussein
Presidência da UE condena atentados de hoje em Bagdad
VEJA AQUI A FOTO GALERIA
CASAMENTO HOMOSSEXUAL
Francisco Louçã manifest se contra eventual referendo
Hoje
O líder do Bloco de Esquerda Francisco Louçã defendeu hoje Condeixa não se justificar que o casamento homossexual seja referendado no país como ponderam solicitar diversas associações ligadas à defesa...
BASQUETEBOL
Jogador da Ovarense faleceu ao intervalo do jog
Hoje
O basquetebolista norte-
Cartão de Crédito Citi com anuidades GRÁTIS. Adira já!
RSS Last minute officially ...Venezuela: Chavez drew Filed against the police by "virtual" sex ... centres ...
Diário de Notícias
BEGINNING SPORT POSTER SCHOLARSHIP PEOPLE SPECIAL GALLERIES FILE
Portugal Globe Economy Science Arts TV & Media View People
IRAQ: DOUBLE ATTACK
New balance points to 132 dead and 520 injured
Hoje
The Iraqi authorities have reported that rose to 132 the number of killed in double attack occurred today in the Centre of Baghdad, the more bloody year, which caused even 520 injured.
The most serious attacks since the fall of Saddam Hussein
EU presidency condemns today's attacks in Baghdad
HERE'S THE PHOTO GALLERY
GAY MARRIAGE
Francisco Louçã against possible referendum
Hoje
The left block leader Francisco Louçã Condeixa today defended not justified gay marriage in th country is curriculum will nee How to balance request various defence-related associations.
BASKETBALL
Player ad ovarense died while game range
Hoje
The American basketball Kevin Wildemond, ad ovarense, died today in time with the
Done
Internet | Protected Mode: Off
100%

New challenges / opportunities

- Secure computing / communication
  - Worm/virus removal
  - Web search spam, click fraud
- Information search / retrieval:
  - Internet, Intranet, and personal
  - Social metadata
- Federated / distributed databases
- Media management
- Mining of high-volume data
  - Bio, medicine, scientific applications
  - Increasingly in business applications, as well
- Cloud services with mobile clients

Microsoft Research

- Redmond, Washington (Sep 1991)
- San Francisco, California (Jun 1995)
- Cambridge, England (July 1997)
- Beijing, China (Nov 1998)
- Silicon Valley, California (July 2001)
- Bangalore, India (Jan 2005)
- Cambridge, Massachusetts (July 2008)



MSR Redmond

MSR Asia

MSR Silicon Valley, CA

MSR Cambridge, UK

MSR India

MSR New England

World-class talent

11 IEEE Fellows

2 IEEE Emanuel R. Piore Awards

4 Royal Academy of Engineering Awards

1 National Academy of Sciences Award

2 Draper Prizes

8 ACM Fellows

1 Kyoto Prize in Advanced Technology

6 American Academy of Arts & Sciences Fellows

1 CHI Lifetime Achievement Award

1 Fields Medal

3 Turing Awards

1 Foreign Member, Royal Swedish Academy of Sciences

19 National Academy of Engineering Members

1 American Association for the Advancement of Science Award

2 John von Neumann Medals

3 Royal Society Fellows

MSR mission statement

- Expand the state of the art in each of the areas in which we do research
- Rapidly transfer innovative technologies into Microsoft products
- Ensure that Microsoft products have a future

Value of Microsoft Research to Microsoft

- Source of IP and new product technologies
  - Microsoft Research generates about 20% of Microsoft's patents
  - MSR patents are more "fundamental"
- Problem solving
  - Ability to bring smart people together to rapidly address hard problems confronting products, product groups, or the company
- Early warning system
  - Ears to the ground in new areas, across a broad range of technologies

Microsoft Patent Award

Inventing the future

- Interactive Visual Media
  - Graphics and multimedia
  - Digital photography and video
- Platform Elements
  - Networking, operating systems
  - Mobile phones and services
  - Sensor networks
  - Security, protection against malware
- Software Development
  - Languages, tools, compilers
  - New SWEPT cross-lab effort for the creation of new SW development tools
- Data and Documents
  - Data solutions for a petabyte world
  - Search
  - Fighting junk communications
- UI and Collaboration
  - Speech, ink, natural language, gesture
  - Machine Translation
  - Meetings and collaboration
  - Modeling of people and groups
- Science
  - CS-designed vaccines (HIV), quantum computing, astronomy

MSR culture

- Corporate funding
  - we use a small part of Microsoft's ~$9.5B R&D budget
- Typical profile of a Researcher:
  - went through extensive hiring process
  - significant freedom
  - incentive to publish
  - staff software engineers for efficient prototyping
  - support from "special projects" engineering team
  - support from MSR legal team – quick path from idea to patent
  - collaborations with world-class experts in multiple areas

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Collaborations with product groups

- It's a social process
  - campus environment is key
- TechFest in March, ~5,000 attendees
- MSR must understand needs of product teams
  - Burden is on us to break prejudice
  - Staff engineers key to building robust prototypes
  - Program Management team helps establish/foster connections
  - MSR must write code (good code, not just "math dump")
- MSR must help with long-term vision
  - What will be possible in 5-10 years?
  - Map that into concrete steps with short- and mid-term goals

Examples of MSR tech transfers

- New ranking algorithms for Bing
- Sensors in Xbox “Natal”
- Superfecth for Vista and Windows 7
- Speech & handwriting recognition
- Network management tools and algorithms
- Software design/testing tools - used to build Windows
- Data cleaning, auto admin
- StreamInsight: SQL 2008 R2
- ClearType, media formats (WMA, JPEG XR, H.264)
- Microsoft RoundTable & Surface
- Microsoft Tag
- Junk e-mail filters
- Desktop search
- Machine translation in Bing
- Audio processing in Windows
- Many, many more…

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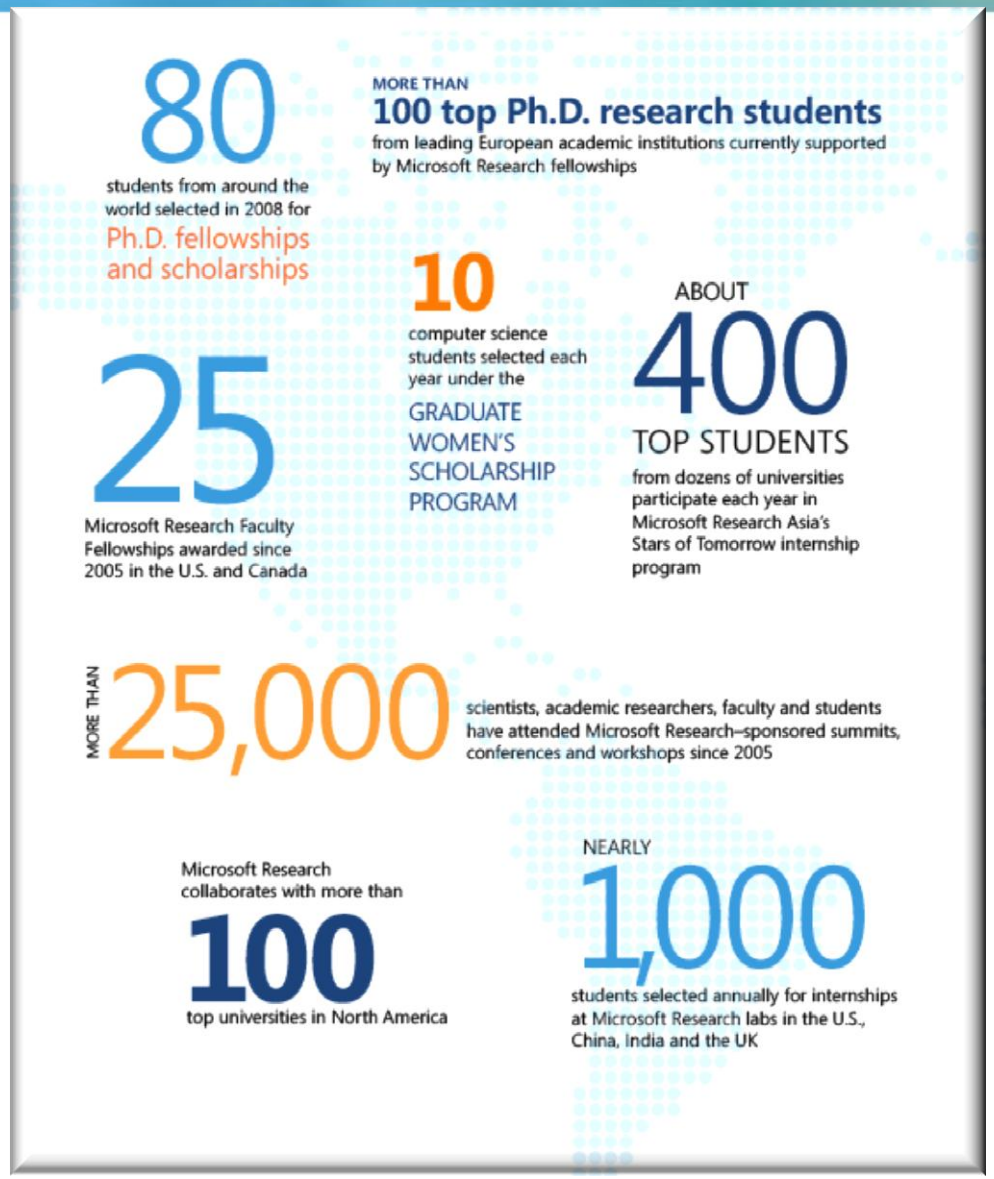
MSR external impact

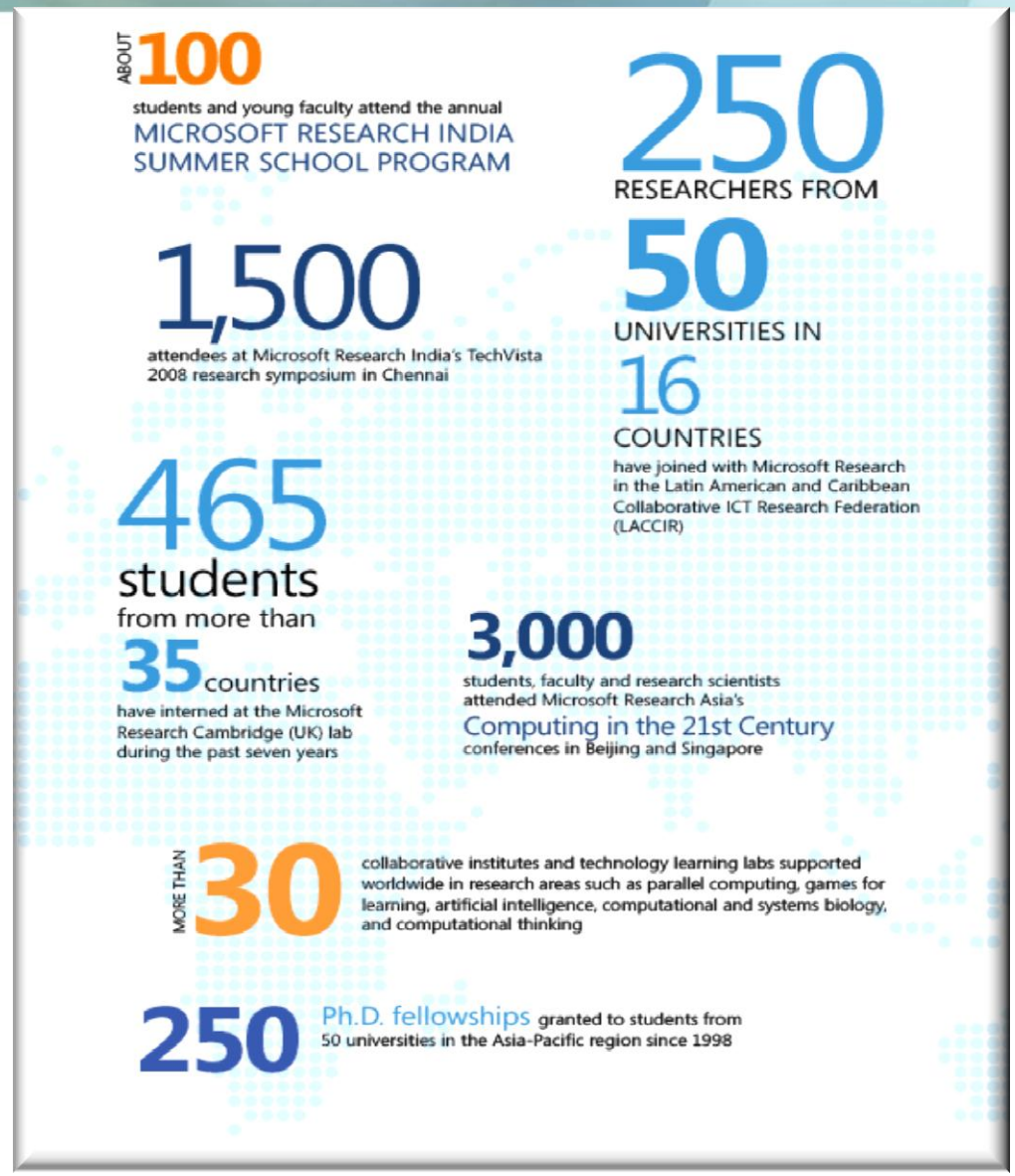
- Hundreds of publications per year
- Dozens of conference chair positions
  - General, technical, program committees, etc.
- Conference impact:
  - 40% of papers at UIST 2009
  - > 30% of papers at SOSP 2009, OSDI 2008, PLDI 2001
  - 22% of papers at SIGCOMM 2008
  - 18% of papers at SIGIR 2008, STOC 2005, SIGMOD 2006
- Largest single contributor to many conferences:
  - SIGGRAPH 2004, SIGIR, SIGMOD & OSDI 2004, SIGCOMM & ICASSP 2008, SOSP & UIST 2009, etc.

Strong interactions with academia

- Active participation in community
  - Conference committees
  - Editing of key journals
  - Professional service – NSF, NRC, DARPA, …
- Strong ties with universities
  - Faculty Summits
  - Worldwide Academic Summits
- Extensive visitor and speaker program
  - Students, faculty, research scientists
  - Post-docs, sabbaticals, interns
  - ~300 interns in MSR Redmond in 2009~1,000 worldwide largest intern program in IT industry

Worldwide talent support



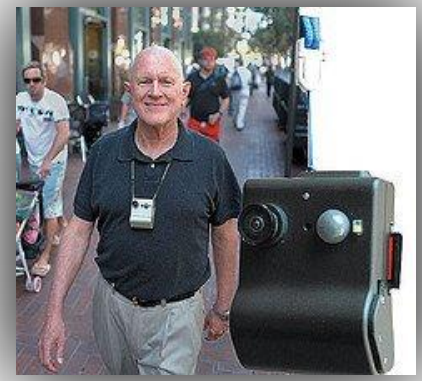


Academic programs

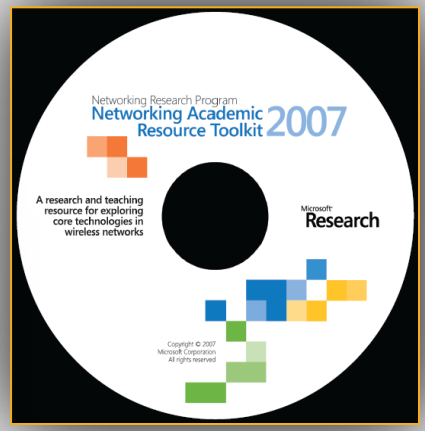
- Support programs
  - Gift grants
  - Young faculty awards
  - Request for Proposals
  - Conference support
  - Technology Centers
  - Research Institutes
  - Graduate Fellowships
  - Young faculty awards
- Collaboration
  - Royalty-free patent licensing
  - Joint research programs
  - Technology sharing

MSR Cambridge

SenseCam

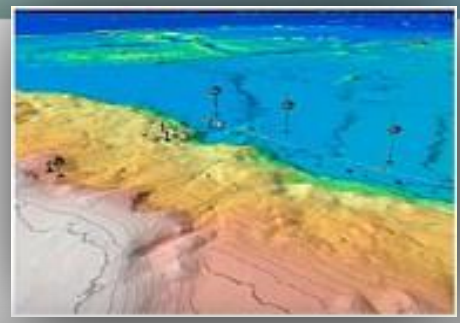


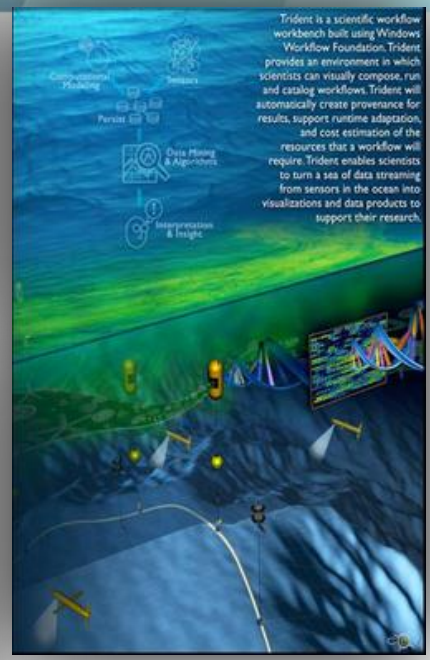
Networking Research Program
Networking Academic Resource Toolkit 2007
A research and teaching resource for exploring core technologies in wireless networks



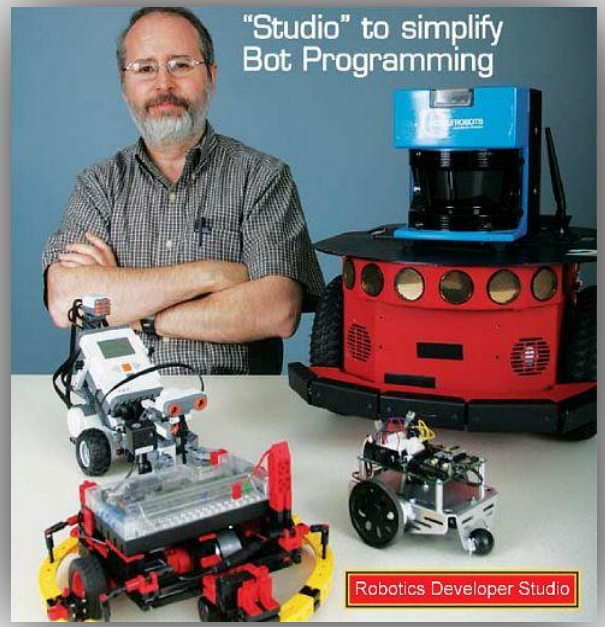
Tools for collaboration with academia

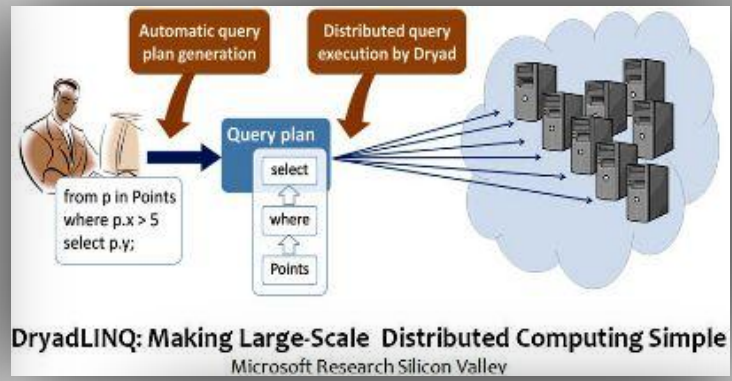
- Trident – scientific workflow
- DryadLINQ – distributed computing

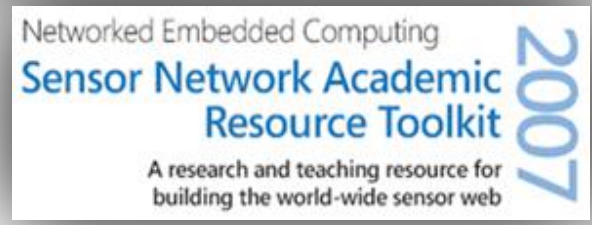


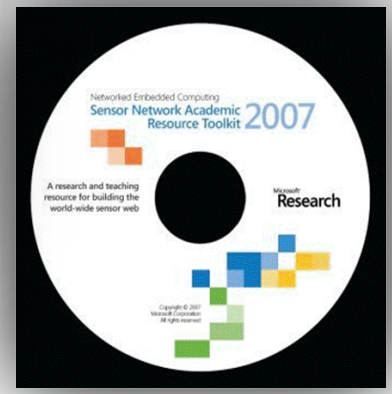


- MS Robotics Developer Studio





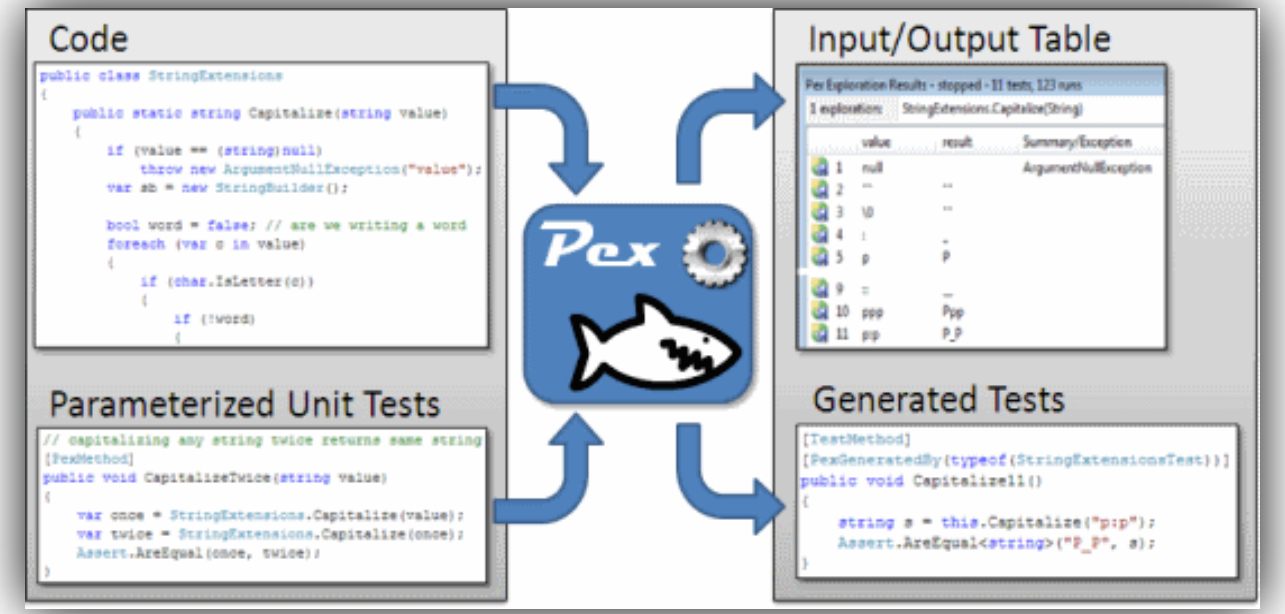




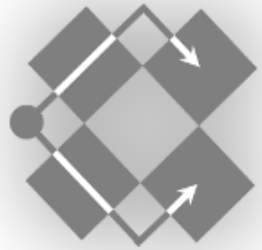
- MSR Sensor Network Academic Toolkit

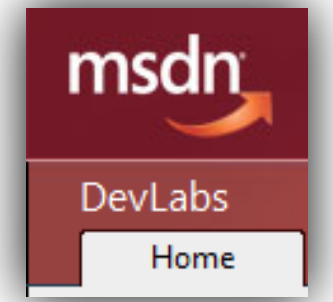
MSR software engineering tools

- Pex - Automated white box testing for .NET
- Z3 – efficient SMT solver
- Code Contracts now in VS 2010



- CHESS – find and replace heisenbugs





WikiBABEL

- Tool for creating multi-lingual content
- Community creation of parallel data
- Light user interaction, efficient architecture

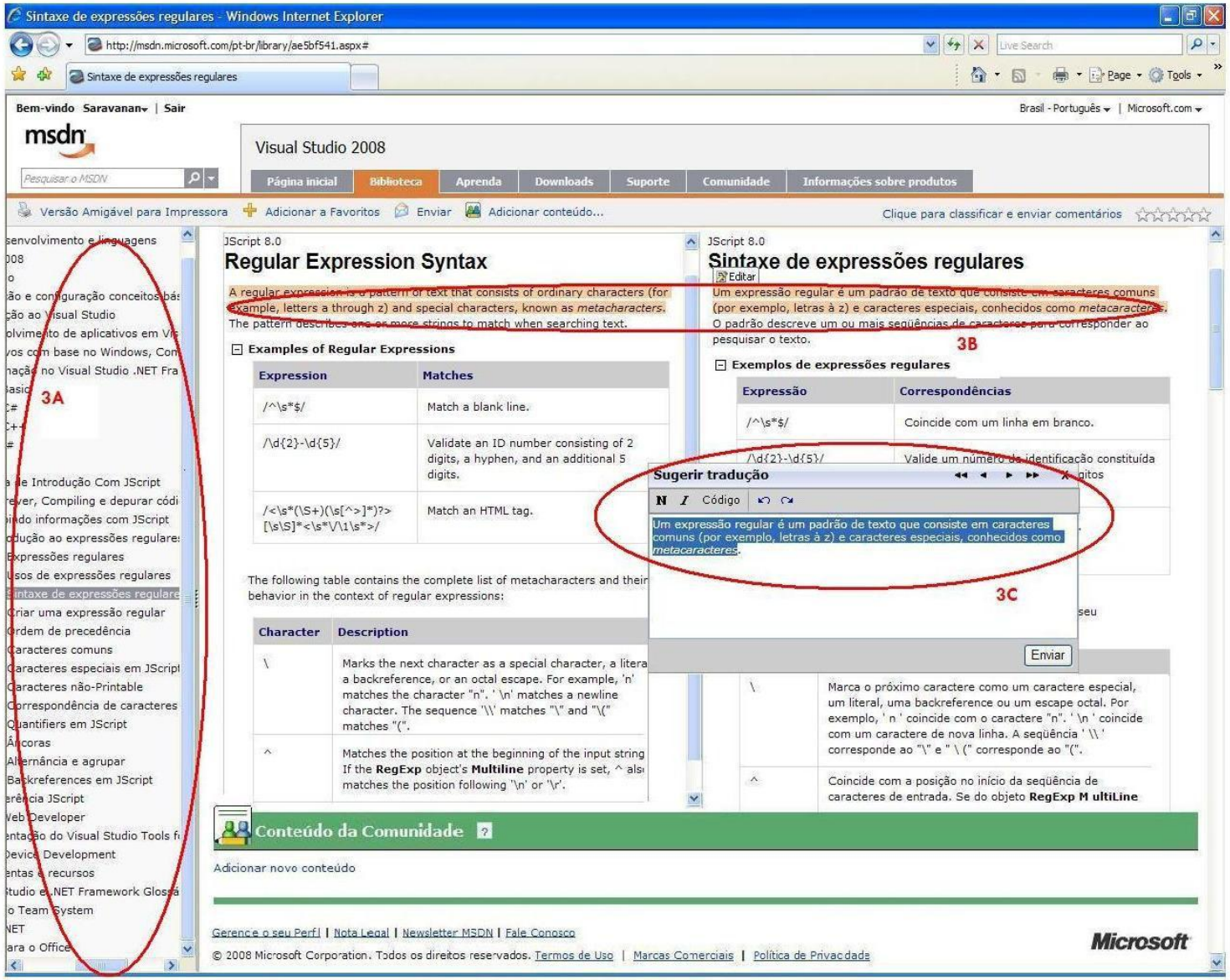
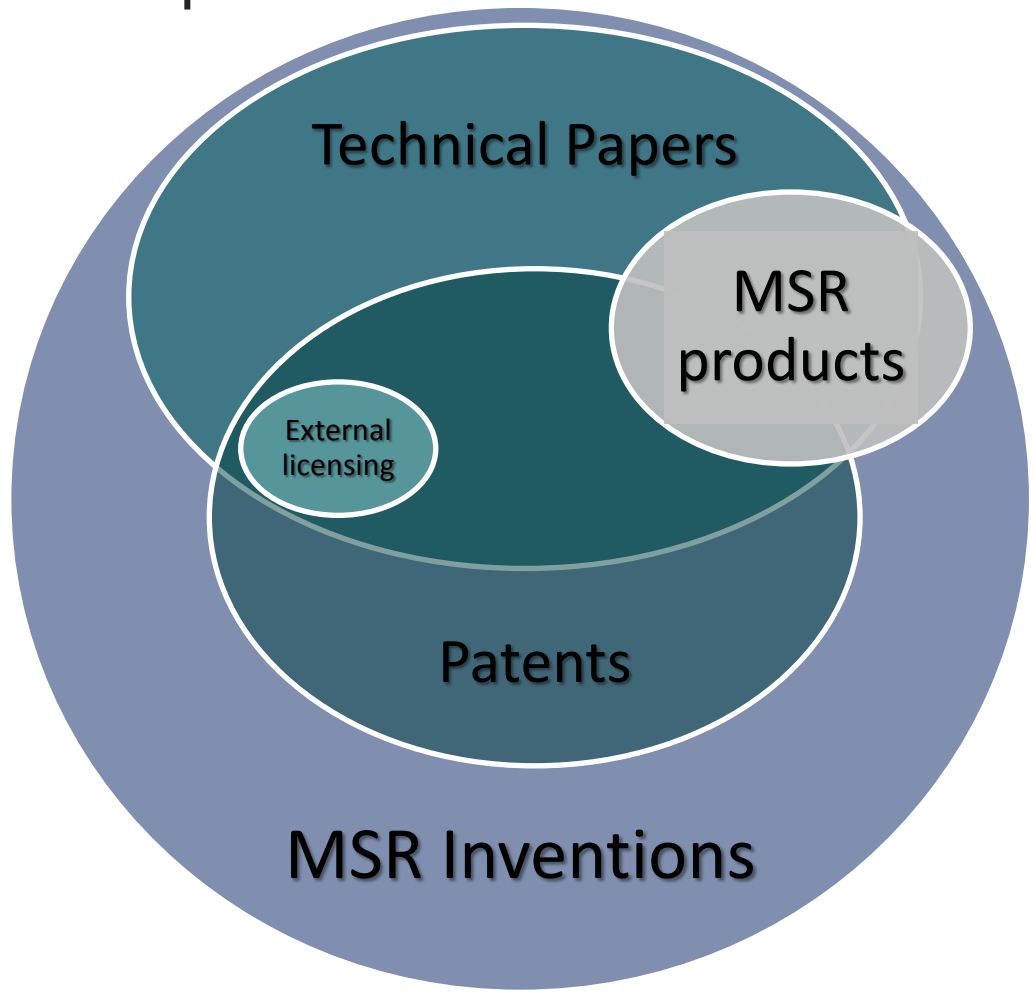


Figure 3: wikiBABEL on MSDNwiki Data

IP licensing

- Technology licensing to dozens of companies:
  - Pex (code analysis):
    - 3M
    - Credit Suisse
    - Electronics Arts
  - Audio search
    - State of WA, Montana digital archives
    - ORLive.com
    - Office of Science and Technology
    - Information
  - SearchTogether
    - Coleman research
    - Glaxo Smith Kline



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Microsoft Tag: MSR → SBG

- New color barcode easily readable by cell phones
- Customizable:

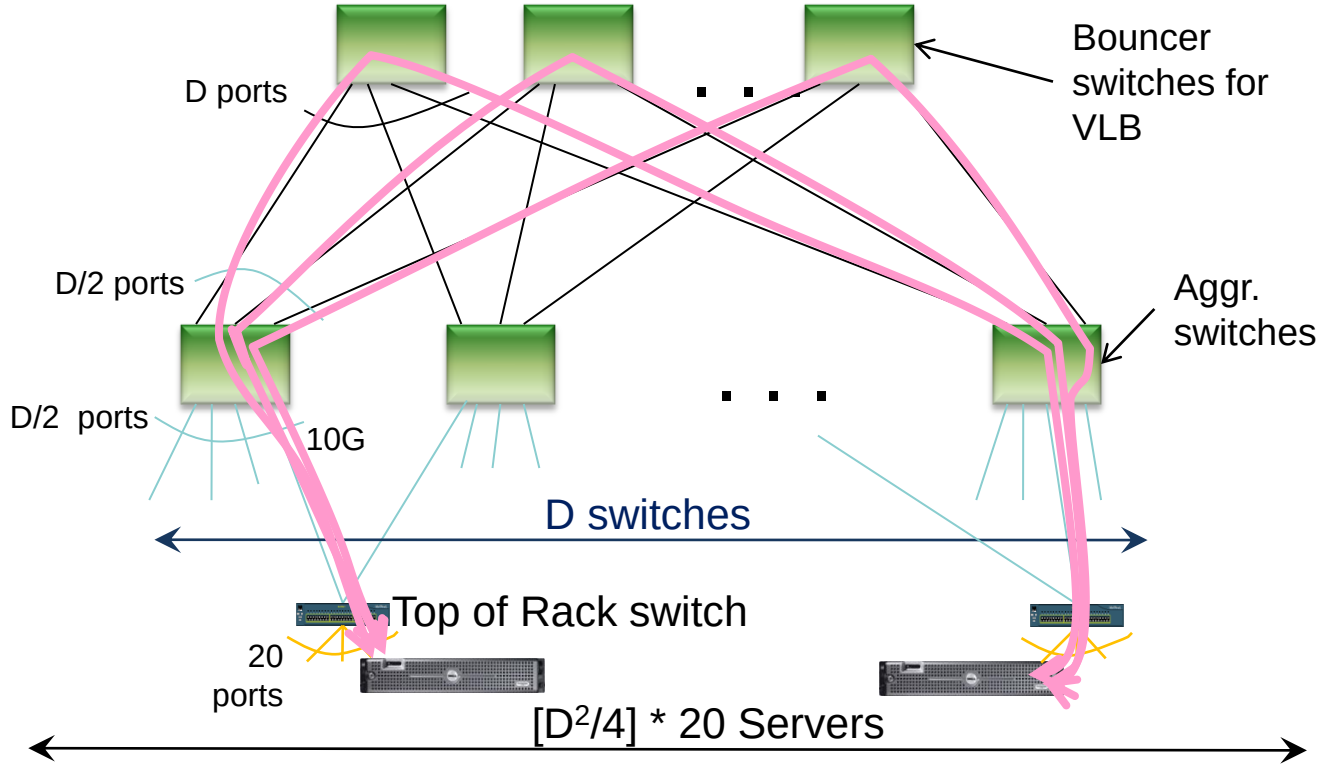
- One-touch mapping of physical world to Web services
- Available on all Microsoft's business cards
- Many partners in early phase: Wal-Mart, Ford, P&G, Best Buy, NL Transit…

If you have **Microsoft Tag** reader on your phone, snap the tag below to get my vCard:

SNAP IT

Get the free app for your phone at
http://gettag.mobi

Monsoon – new data center switching



Node degree (D) of available switches & # servers supported

D	Servers in Pool
24	2, 880
48	11,520
144	103,680

ON THE WAY TO $100 PER 10G PORT

- Mesh-like w/ programmable commodity layer-2 switches and servers
- Topology with multiple paths and huge bisection bandwidth
- Valiant Load Balancing used to cope with traffic volatility
  - Every flow "bounced" off a random intermediate switch
  - Provably hotspot free for any admissible traffic matrix

Audio search

- Search for speech in audio recordings
- Does not use speech recognition technology

- Maps search terms to audio patterns
  - search for such patterns in waveform
  - better results than ASR

Auto-Receptionist – prototype

wide-angle camera

4-element microphone array

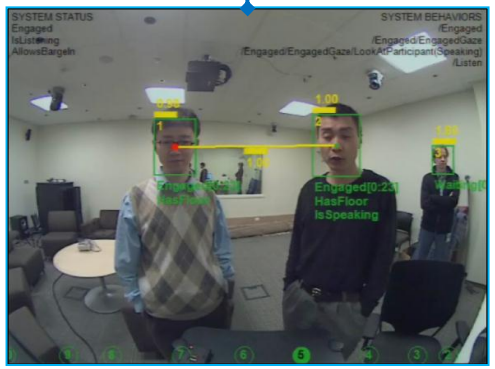
touch screen

card reader

speakers

eight-core PC

monitoring screen



Speech Synthesis

Avatar Synthesis

Speech Recognition

Tracker

Output Management

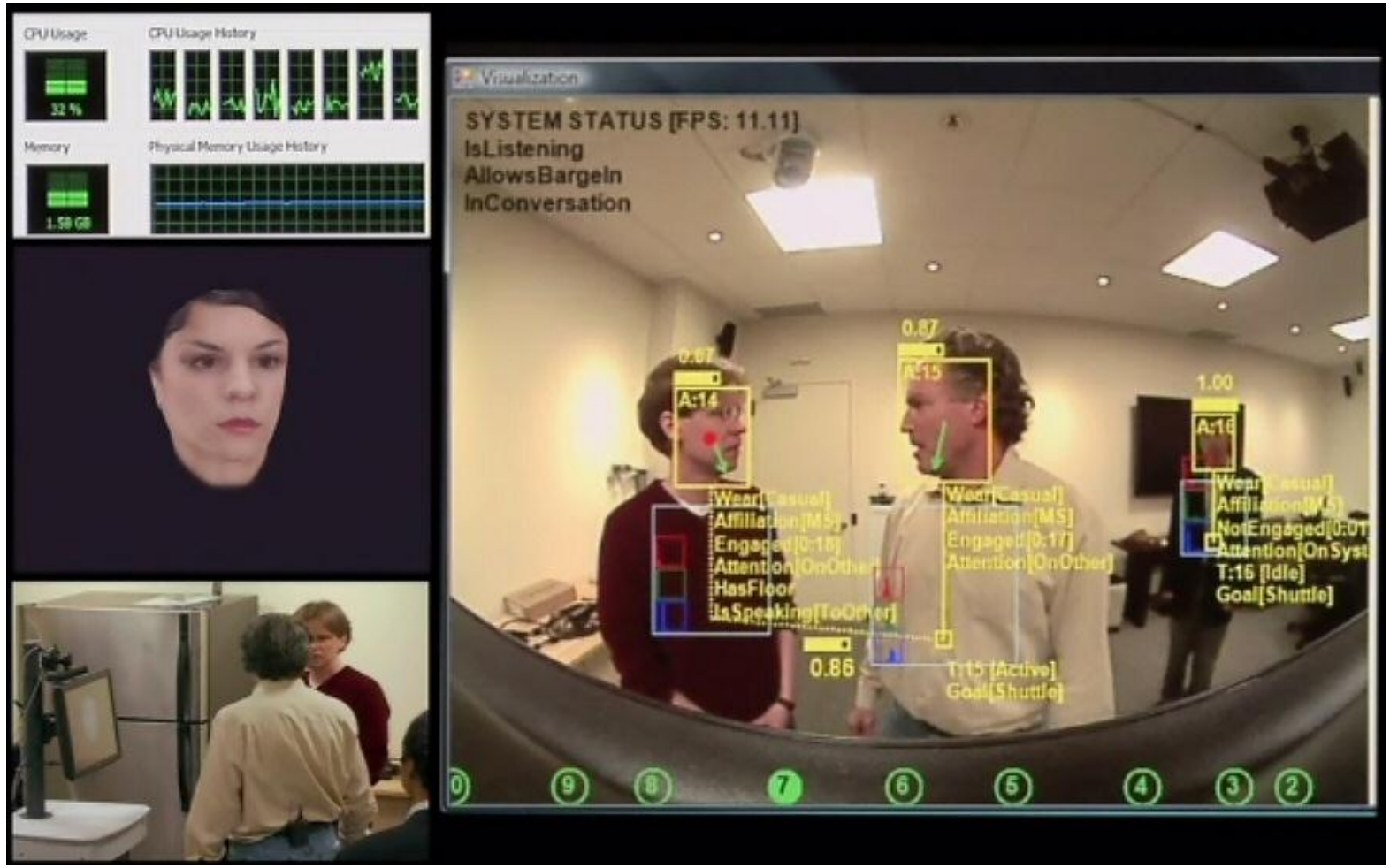
Conversational Scene Analysis

Behavioral control

Dialog management & Interaction Planning

Microsoft Robotics Studio
[Concurrency, Coordination and Distributed Services]

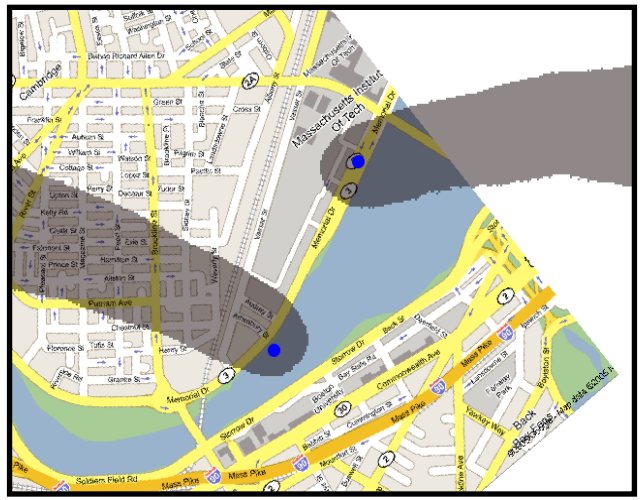
Auto-Receptionist – demo



Auto-Receptionist – demo

Lucid touch

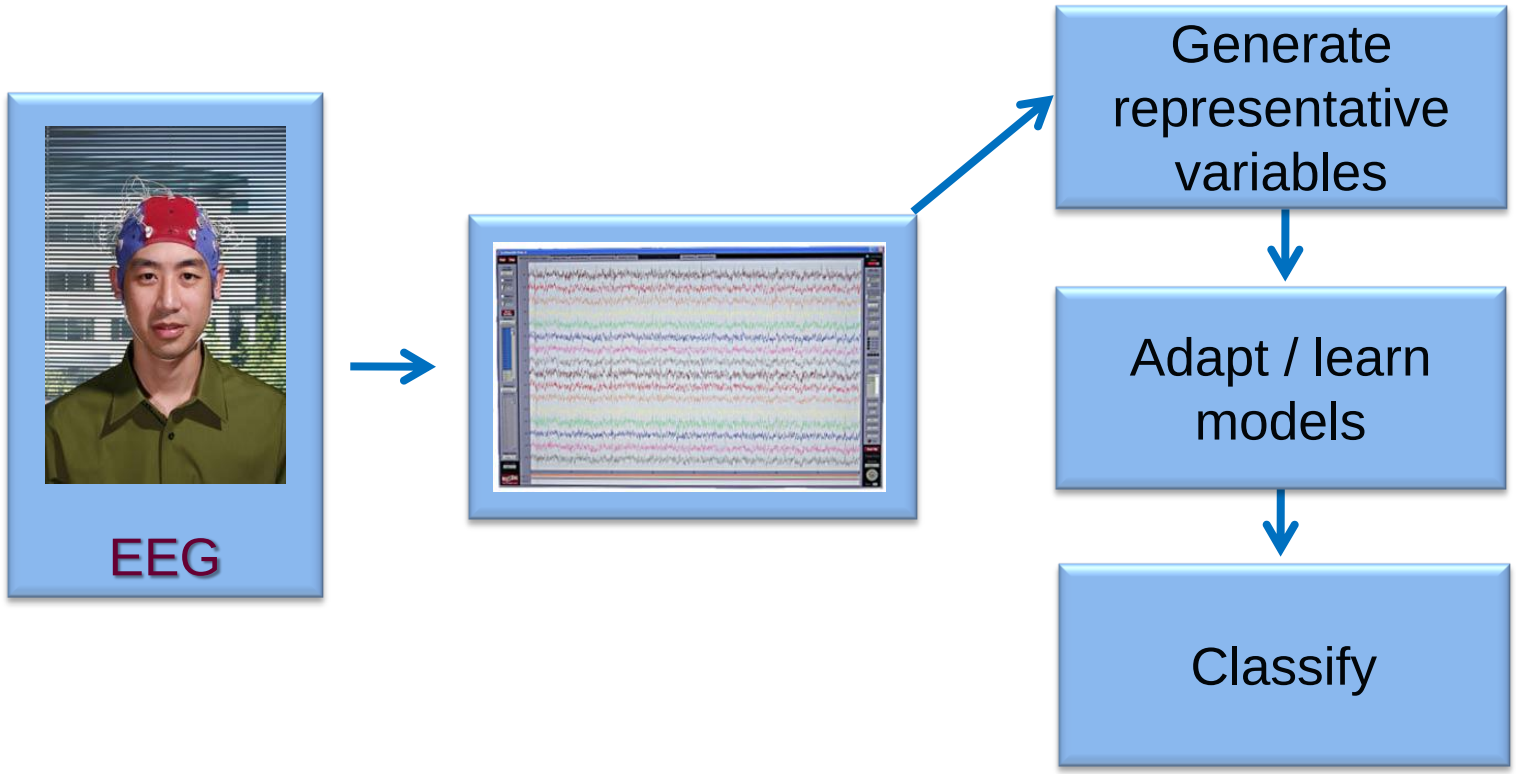
- Touch screen from the back



- Synthesize virtual shadows of fingers
- Fingers can point to displayed objects without blocking view

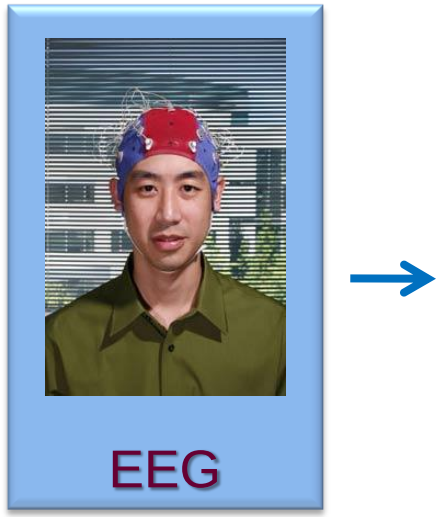
Brain interfaces

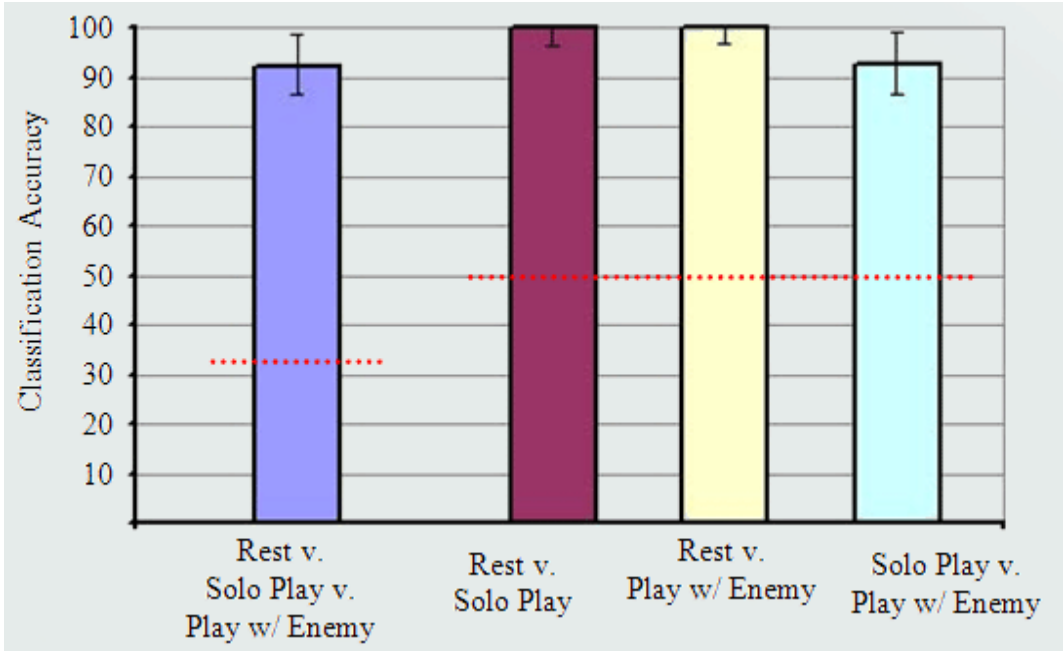
- Understanding thoughts



Brain interfaces – initial results

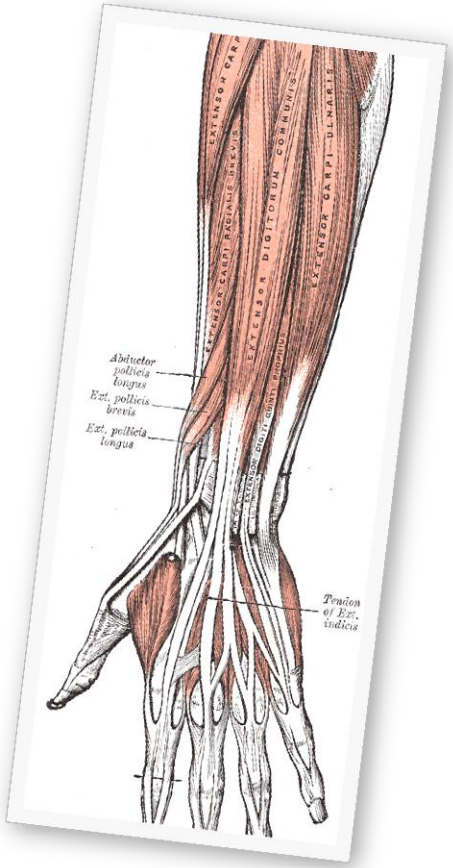
- 84% to 94% classification precision

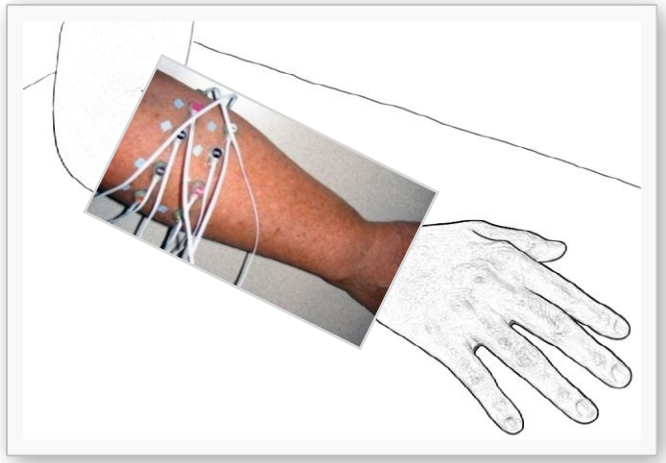


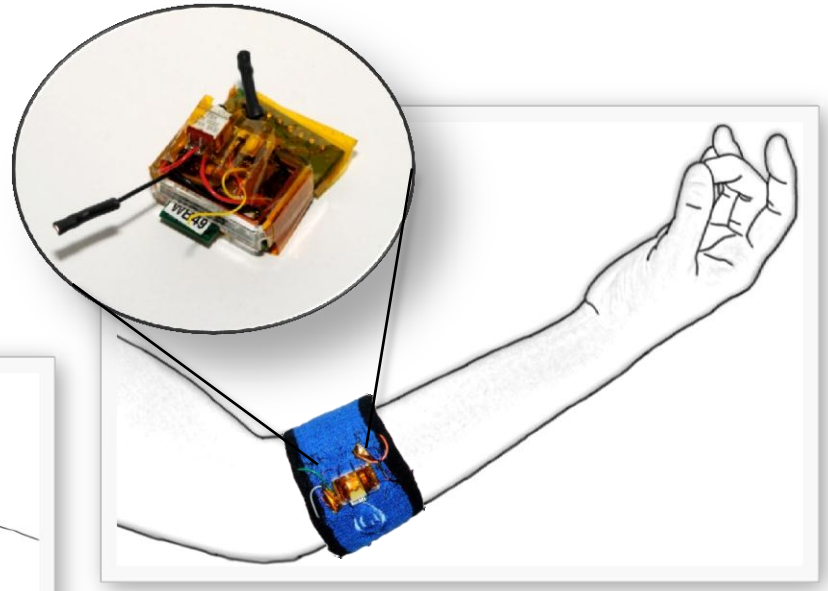


Desney Tan received a 2007 MIT Technology Review TR35 Award

Muscle sensing armband



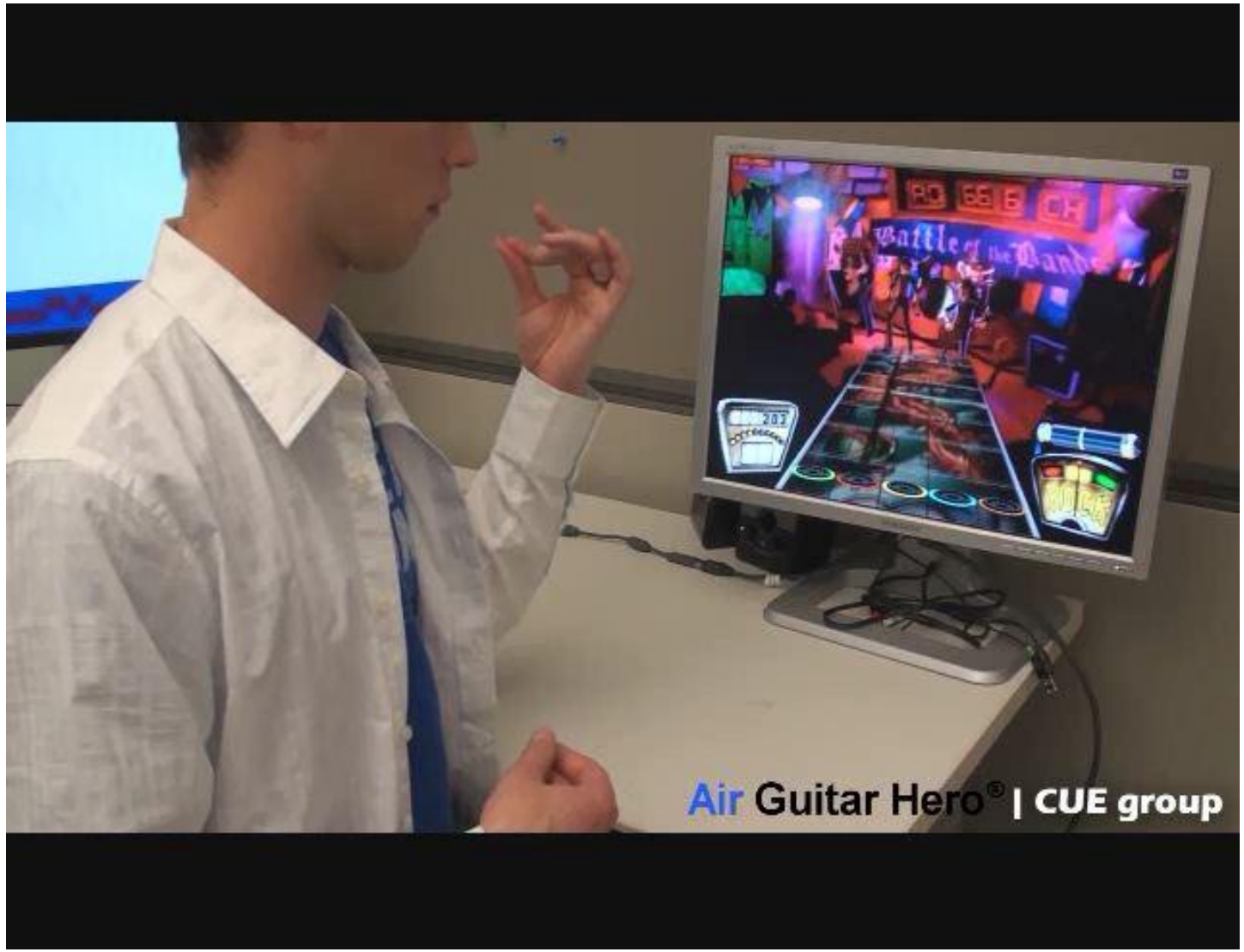




Measure electrical activity with Electromyography (EMG)

Muscle sensing armband

- “Air” Guitar Hero
- Real-time signal classification & game control

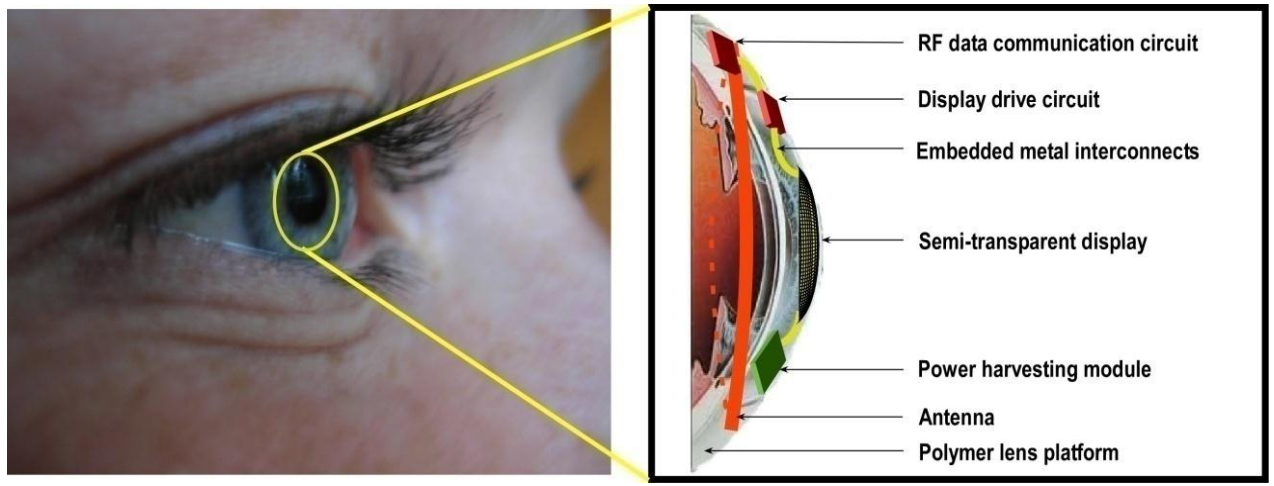


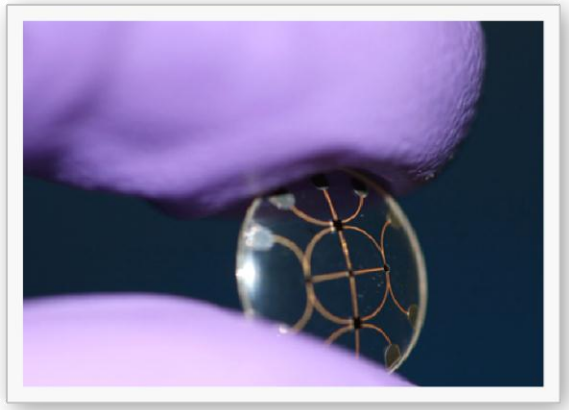
Muscle sensing armband

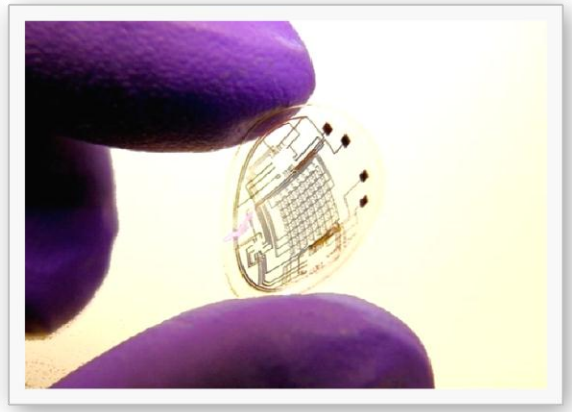
- “Air” Guitar Hero
- Real-time signal classification & game control

Bionic lenses

- Display info without disrupting perceived attention
- Great display for augmented reality
- Resolution still low, will improve with time
- Power must be very low, recharge by eye movement

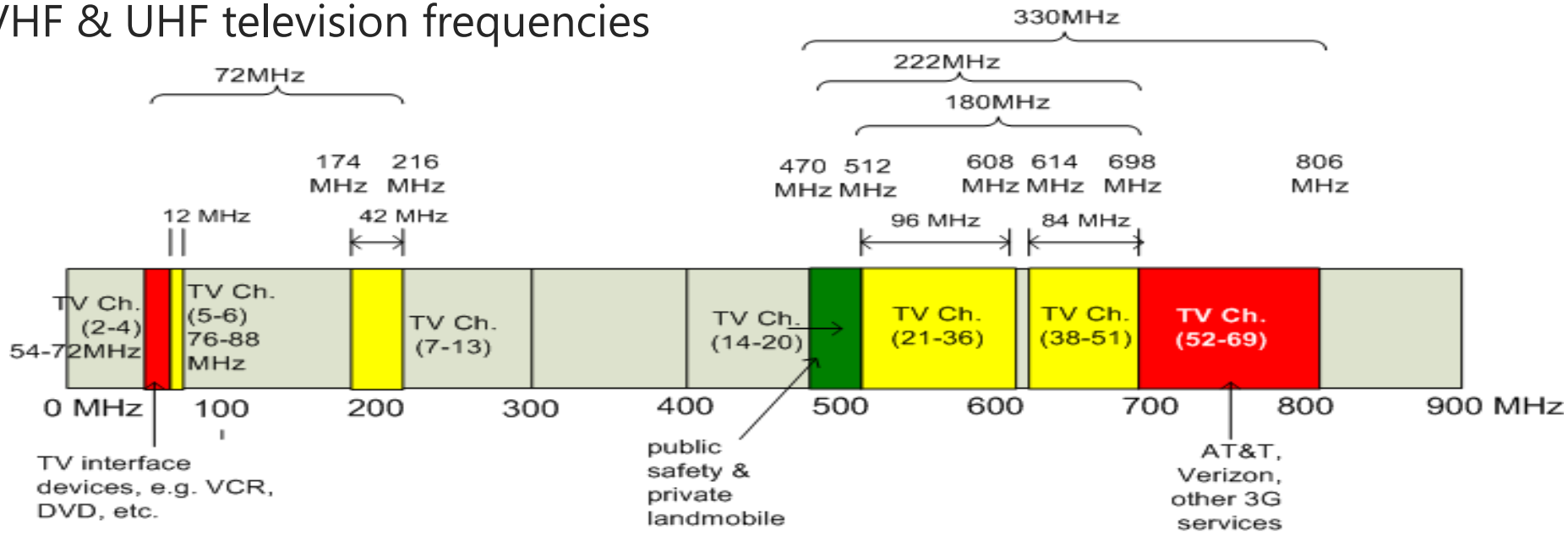






White Spaces

- Unused VHF & UHF television frequencies



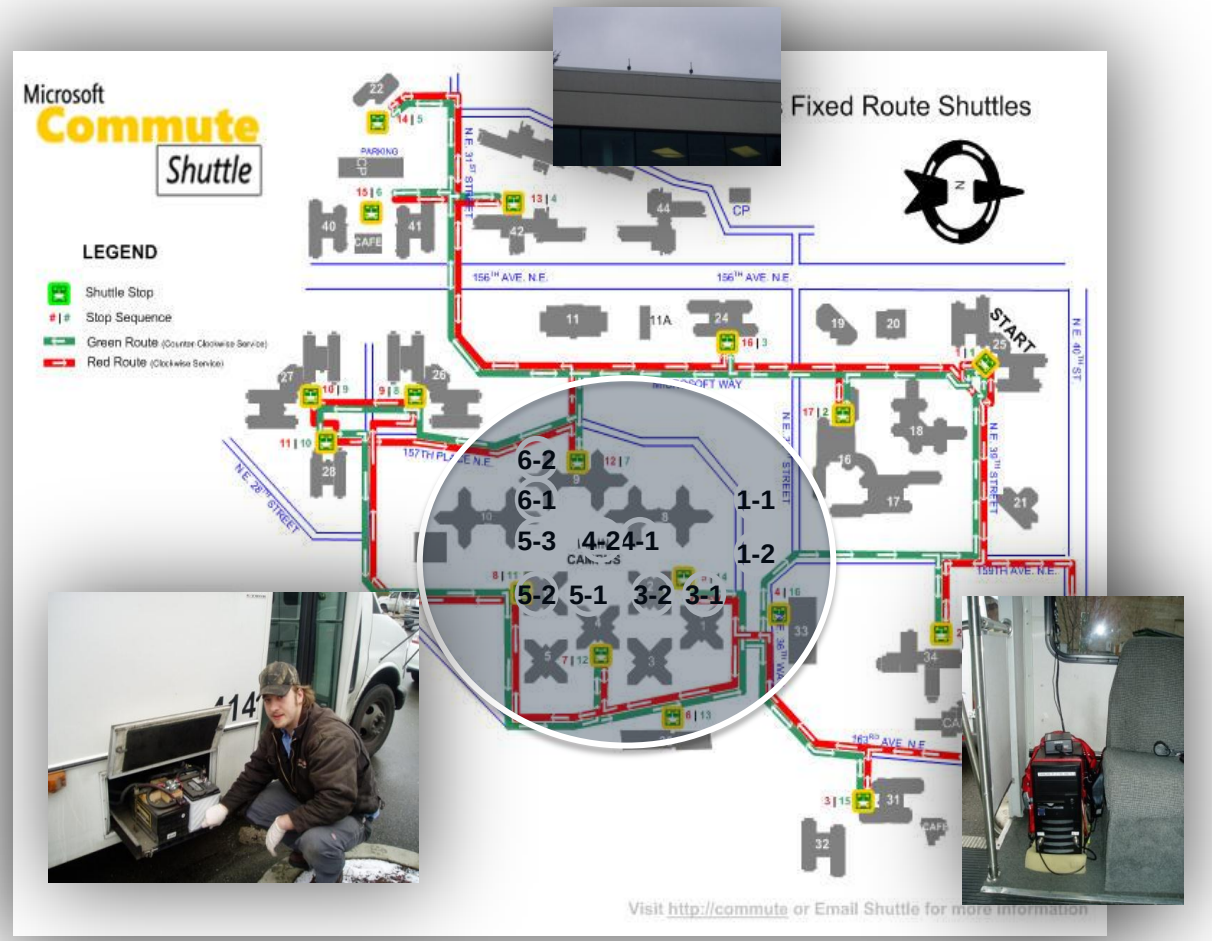
- In the US: primarily the upper UHF “700 megahertz” band (TV channels 52 to 69)
- White Spaces Coalition: Microsoft, Google, Dell, HP, Intel, Philips, Earthlink, Samsung

- Inexpensive technology for last-mile broadband access

First White Spaces campus network

- WhiteFi + Geolocation
- FCC Experimental License July ‘09

- Area: 1 square mile
- Perimeter : 4.4 miles
- WSD on 5-10 campus buildings
- Fixed BS operate at 2 W EIRP
- WSD inside shuttles at 63 mW



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