

# Universal Telecommunication Oriented Personal Information Access (UTOPIA) - An Intl. IT Collaboration Project Proposal

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# Outline

- UTOPIA and enabling technologies
- Brainpower needed for developing UTOPIA
- Sculpture and Software - an analogy
- Cultural advantages, religion, and challenges
- Possibilities of co-operation in competitive societies – what are the mechanisms?
- Impact on infrastructures and operating modalities - rural areas
- UTOPIA Projects and Pricing structure

# UTOPIA

- Global – Universal Telecommunication Oriented Personal Information Access
- Local – University/Town (village) Level Object based Personal Information Access
- Use robust PDAs, smartphones, and thin clients for user interface and display in developing countries.
- Leverage mechanisms and protocols developed for Distributed and Grid Computing to obtain access to computing resources.
- Use PCs, Laptops, and other computers as intermediaries for communication and storage.

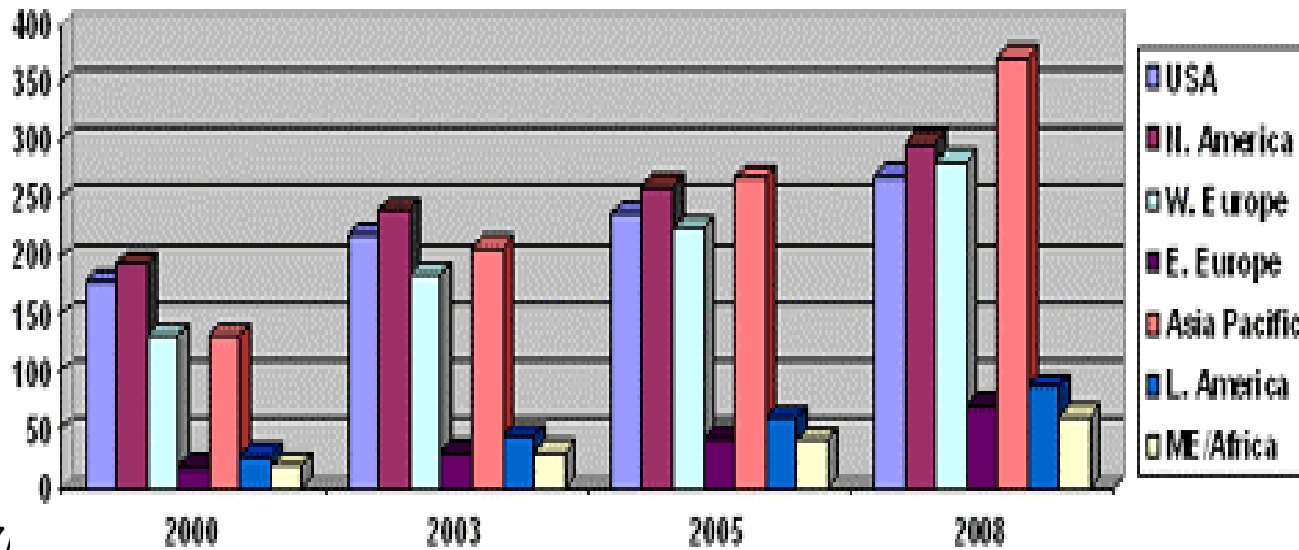
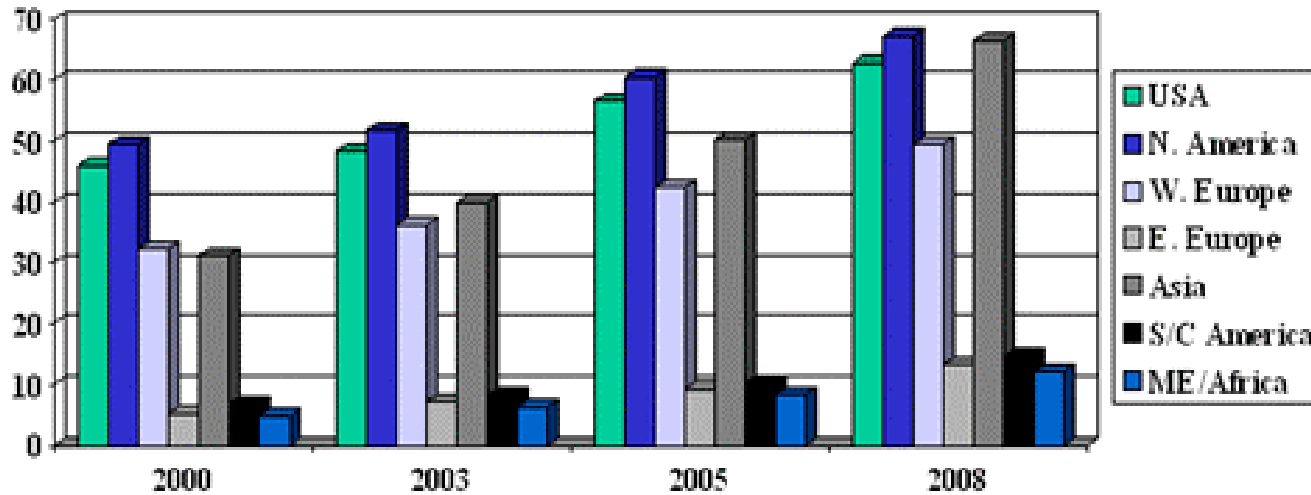
# Enabling Technologies

- Cell phones and Smartphones
- Wireless communications (802.11ag, WiFi, WiMAX)
- Low-cost sensors (digital camera, video camera, microphone, infrared camera, pressure sensors)
- Distributed real-time middleware (TMO)
- Realistic viewing on smartphones
- Information Grid and real-time Grid computing
- Ad-hoc networks and mesh networks

# Technical Challenges

- Diverse user interfaces:
  - touch sensitive display with stylus,
  - speech recognition for many languages,
  - colorcode/camera combination for object recognition
- Low-cost PDAs that are reliable and robust.
- NANOS - small foot-print real-time OS that can handle the user interfaces and real-time user interactions.
- Base stations that are self-sustaining and low-cost for deployment in rural areas for high data rate wireless communication.
- Intensive efforts in modeling, analysis, language translations, and application software.
- Lots of field trials have to be conducted in universities, towns, villages, rural areas, and cities.

# PC - World Market



# PC - World Market for Next Decade

- China - 120 M to 130 M
- India - 100 M to 110 M
- Brazil - 40 M to 60 M
- USA - 300 M to 350 M
- EU - 200 M to 220 M
- ME - 60 M to 70 M
- Africa 80 M to 100 M

# Cell Phones

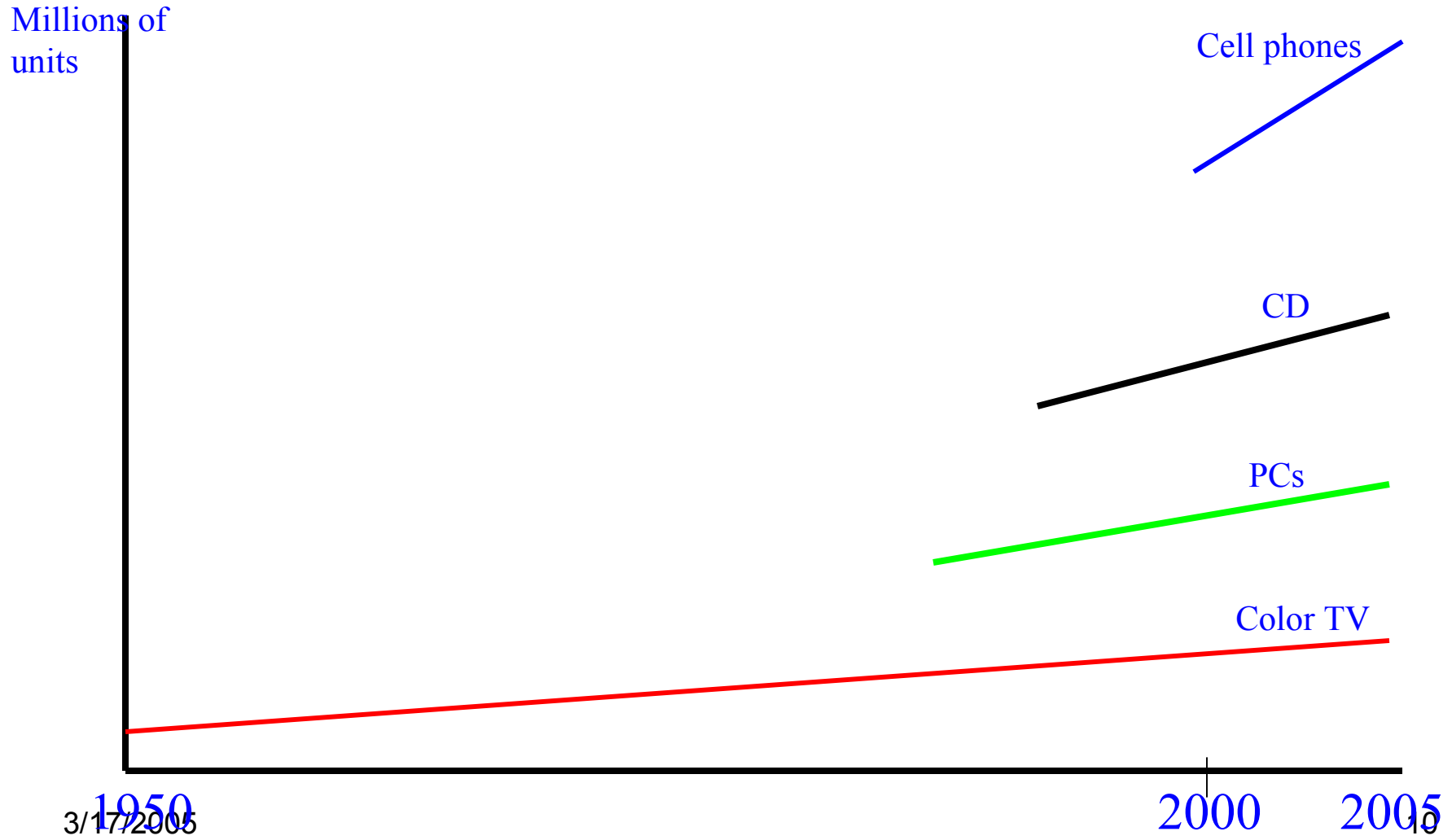
- 675 M units in 2004
- 580 M units in 2003
- 18% to 20% growth rate
- Nokia (30.8%), Samsung (13.8%), Motorola (13.45) are the top three suppliers
- cell phones in India - 45 M in 2004
- cell phones in China - 320 M in 2004
- Growth rate could be higher if telecom market is opened up for competition.



# Cell Phone Market for Next Decade

- Low-cost smartphones can enable UTOPIA in the next ten years
- More than 700 M phones in India for education and personal access
- More than 600 M phones in China
- More than 600 M phones in Africa
- More than 1200 M phones for the rest of the world

# Growth Comparison



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# Brainpower Needed for UTOPIA

- Financial experts for developing novel approaches for funding rural entrepreneurs.
- Legal experts for developing institutions in rural areas.
- Business experts for developing business models.
- Communication and technology experts for adapting wireless technology to the rural needs.
- Programmers and analysts for modeling, simulation, and implementation.
- Sociologists and economists for planning and organizing.

# Sculpture

- Abundance of basic material (granite rocks) in certain parts of the world
- Simple tools – hammer and chisels
- Outsourcing – sometime it is cheaper to move projects and sculptors to places where the rocks are
- Terrific imagination on the part of the chief architect / sculptor
- Mental visualization of the end result by individual sculptors
- Effective training of young sculptors by seniors

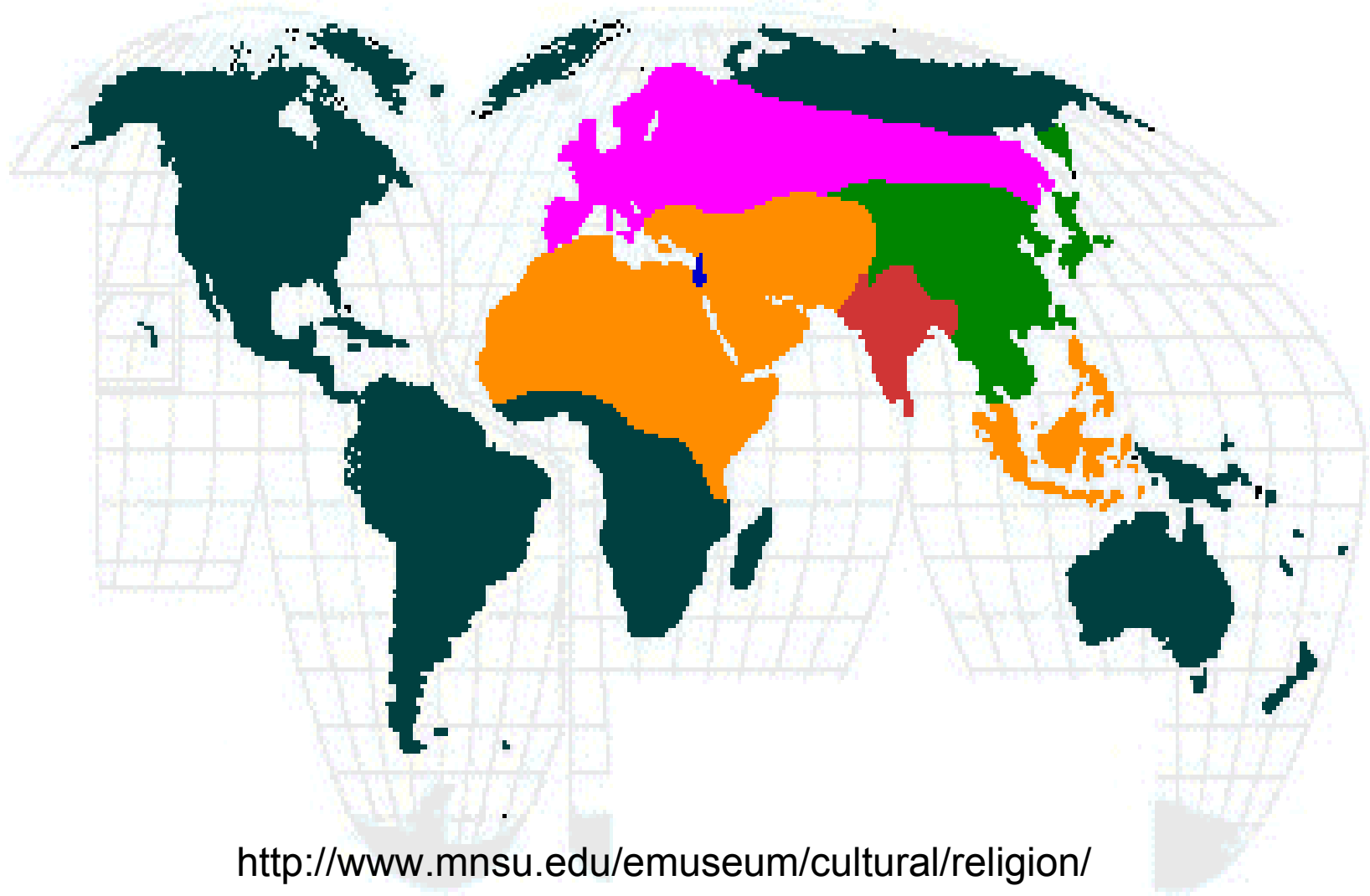
# Software

- Abundance of people with basic programming skills (C, Java, DB2) in India, China, Korea
- Simple tools - Desktop computers, compilers for programming languages, user interface tools
- Outsourcing - cheaper to move software projects to places where programmers and engineers are located.
- Knowledge of how things work and terrific imagination on the part of systems analysts and programmers
- Training of new programmers and analysts using programming teams and vocational training institutions

# Culture

- Cultural differences and economic opportunities resulted in conflicts, colonialism, and mutual suspicion prior to industrial revolution.
- Marginal trickling down of industrial revolution to Asia until 1940s due to colonialism.
- Benefits of industrial revolution spread to NEA, SEA, and India only in the second half of 20<sup>th</sup> century to alleviate poverty, disease, and increase agricultural productivity.
- IT revolution has the capability to promote progress in the next decade for all countries and US could provide the leadership with countries such as China, India, EU, Japan, and Korea.

# World Cultures Prior to Industrial Revolution



<http://www.mnsu.edu/emuseum/cultural/religion/>

# Cultures Before Industrial Revolution

- Animism – existence of spiritual beings
- Christianity
- Hinduism
- Islam
- Judaism
- Buddhism



# Major Religions of 21<sup>st</sup> Century

Christianity 2 billion

Roman Catholicism: 1.1 billion Protestantism: 360 million

Eastern Orthodoxy: 220 million Anglicanism: 84 million Other Christians: 280 million

Islam 1.3 billion Sunnism: 940 million Shiism 120 million

Hinduism 900 million

Secular/Nonreligious/Agnostic/Atheist 850 million

Buddhism 360 million

Chinese traditional religion 225 million

Primal indigenous 150 million

African Traditional and Diasporic 95 million

Sikhism 23 million

Juche 19 million

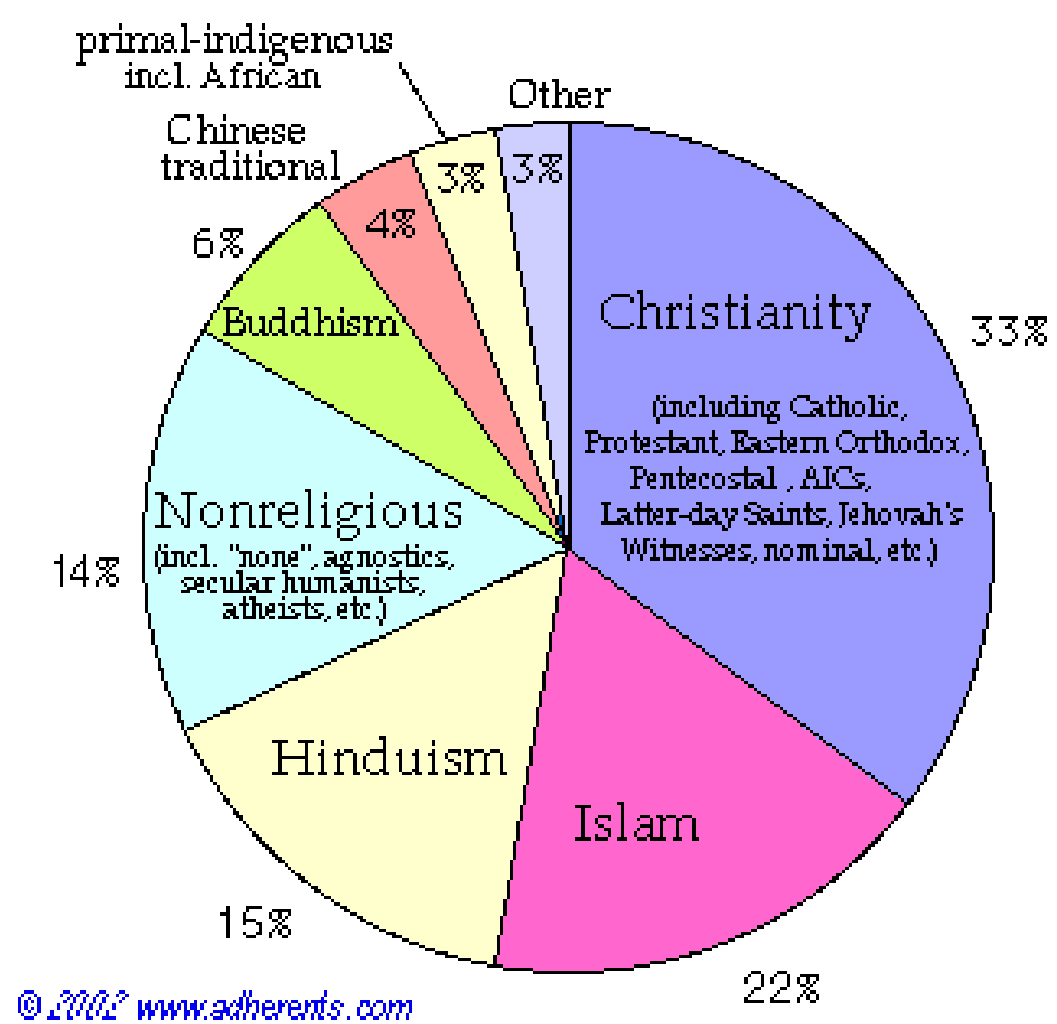
Spiritism 14 million

Judaism 14 million

# Top 10 Organized Religions in the World and Impact of IT in 2004

- Christianity - 30%
- Islam - 10%
- Hinduism - 8%
- Buddhism - 8%
- Sikhism - 12%
- Judaism - 70%
- Bahá'í Faith - 15%
- Confucianism - 10%
- Jainism - 10%
- Shintoism - 7%

# Pie Chart of World Religions - 21<sup>st</sup> Century



# Cultural Challenges

- Wealth and resource gap within regions, states, and among countries.
- Countries are polarized on ideological or religious grounds.
- Polarization within countries and within states.
- Low adult literacy rate in countries like India and large households (6 to 8 people)
- PC penetration impeded by local tariffs.
- Ratio of urban vs rural population in countries
- The assumption of economics (there is basic information available about the state of the market) is not true in rural areas and villages

# Rural Areas

- Rural mass market has numbers on its side.
- It is a long-term challenge for the PC industry to attract this segment to the PC platform.
- This market will likely choose PC alternatives, such as smartphones and thin clients.
- This group has poor communication infrastructure, low-income, and very price-sensitive.
- They lack community infrastructure, funding, communications, and reliable power sources to support PC platforms.
- Wireless communication, solar power, fuel cells and other advanced technologies can play a role.

# Co-operation Mechanisms

- Establish an R&D Center in Irvine, CA for UTOPIA with regional centers in Korea and India (IITBombay).
- Initial funding by Govts. and invite industries from Korea, Japan, China, India, and USA to become members of UTOPIA center.
- Five year commitment from industry (\$100K per year plus one scientist per year) and ten members to make it sustainable after the initial three year Govt. support.
- Results available to members of the center for further development and commercialization
- Invite postdocs and professors from member countries to work with the center on projects.

# Focus at Centers

- Real-time and distributed computing, OS support for real-time context gathering, grid computing - UCI and Konkuk Univ.
- Reality computing - 3-D Graphics for mobile devices, context gathering framework research, and ambient intelligence research - Yonsei Univ. and others in Korea
- User interfaces, speech recognition, applications and rural area demonstration projects - IIT Bombay

# Leverage Mechanisms Developed for Distributed and Grid Computing

- Grid - Coordinated resource sharing and problem solving in dynamic multi-institutional virtual organizations
- Resources are not subject to centralized control.
- Standard and open protocols and interfaces to meet diverse needs and integrate different resources
- Different QoS for different applications and users
- Also leverage Information Grid for obtaining important data and knowledge about things.



# Utilizing Computing Resources

- Livny devised a system known as Condor, a way for over-worked computers to delegate their work to their under-used counterparts.
- Since Condor, the ability to unite computers for a single project has evolved into established concepts such as clustering, parallel computing, render farms, load-balancing, and distributed computing.
- In 2001, a new vision has emerged — 'grid computing'. The idea is that, just as no-one wonders which power station provides the electricity that powers a computer, computers linked together over the Internet into grids will provide all the resources – be they storage, databases, processing power or applications – that anyone needs, whenever they need it.
- Globus, an open source middleware for grid computing, and real-time middleware could be combined to provide services.
- There are over 700 million PCs around the world.

# UTOPIA - Financial Requirements

- Capital for development must be available from many sources
- Liberalized foreign direct investment (FDI)
- Links to world markets
- Legal protection for entrepreneurs
- Finances for domestic private businesses must be less restrictive
- Good institutions and private ownership are vital for economic growth

- Remove barriers to telecom competition
- Provide escape mechanisms for entrepreneurs
- Provide mobility to escape inefficient institutions
- Rural and backward regions must be groomed using indigenous entrepreneurs
- FDI is an urban phenomenon and must be carefully observed
- Hospitable financial institutional environment for the countryside entrepreneurial talent

# UTOPIA - Legal Requirements

- Institute legislation to protect private property rights
- Grant rights to small scale IT industrial workers so that they can have ownership
- Income distribution will boost consumption of goods and demand for UTOPIA
- Adopt sustainable growth paths for all sectors of the economy
- One nation and two systems might not be appropriate for all countries

# Marketing & Pricing Structure

- UTOPIA / ICT4B – provide cell phones, PDAs, handsets, or thin clients free of charge or for a nominal price and gain market share rapidly
- Fixed price for access— good for rural areas
- Price based on total time spent accessing
- Bandwidth based pricing
- Service based pricing
- On-demand TV, movies, guidance, and music

# Success Stories – China/India

- Lenovo – PC – Hong Kong HQed
- TCL – TV sets
- GALANZ – Microwave ovens
- KELON Group – Refrigerator and A/C
  
- LG in India - cell phones
- Nokia in India - cell phones

University/Village

Application 1  
Tour Guide

Application 2  
Services

Target Environment			
	Goals	<ul style="list-style-type: none"> <li>● Provide a tour guide via Mobile Phone</li> </ul>	<ul style="list-style-type: none"> <li>● Provide a daily snapshot of events</li> <li>● Price of commodities</li> </ul>
	Ambient Information	<ul style="list-style-type: none"> <li>● Location information</li> <li>● Tag Interface</li> </ul>	<ul style="list-style-type: none"> <li>● Location information</li> <li>● Tag Interface</li> </ul>
<p>Device</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Smart Phone</li> <li><input type="checkbox"/> PDA/ Notebook</li> </ul> <p>Network</p> <ul style="list-style-type: none"> <li>Wireless LAN</li> <li><input type="checkbox"/> Wi-Fi (802.11)</li> <li><input type="checkbox"/> WiMAX, WiBro</li> </ul>	Basic Function	<ul style="list-style-type: none"> <li>● Context gathering capabilities</li> <li>● Context classification/transformation capabilities</li> <li>● Context discovery &amp; transfer capabilities</li> </ul>	<ul style="list-style-type: none"> <li>● Context gathering capabilities</li> <li>● Context classification/transformation capabilities</li> <li>● Context discovery &amp; transfer capabilities</li> </ul>
	Extension Function	<ul style="list-style-type: none"> <li>● LBS</li> <li>● GPS</li> </ul>	<ul style="list-style-type: none"> <li>● LBS</li> <li>● GPS</li> </ul>
3/17/2005	Etc		31

Town

Application 1  
Restaurant

Application 1  
Events & Services

Target Environment			
	<p>Goals</p>	<ul style="list-style-type: none"> <li>● Provide a various food info via Mobile Phone when people walking the street</li> </ul>	<ul style="list-style-type: none"> <li>● Provide a daily event info on the street when people walking the street</li> </ul>
	<p>Ambient Information</p>	<ul style="list-style-type: none"> <li>● Today Menu service</li> <li>● Recommended Menu</li> </ul>	<ul style="list-style-type: none"> <li>● E-Coupon</li> <li>● E-Auction</li> </ul>
<p>Device</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Smart Phone</li> <li><input type="checkbox"/> PDA, Mobile</li> </ul> <p>Network</p> <ul style="list-style-type: none"> <li>Wireless LAN</li> <li><input type="checkbox"/> Wi-Fi (802.11)</li> <li><input type="checkbox"/> WiMAX, WiBro</li> </ul>	<p>Basic Function</p>	<ul style="list-style-type: none"> <li>● Context gathering capabilities</li> <li>● Context classification/transformati on capabilities</li> <li>● Context discovery &amp; transfer capabilities</li> </ul>	<ul style="list-style-type: none"> <li>● Context gathering capabilities</li> <li>● Context discovery &amp; transfer capabilities</li> </ul>
	<p>Extension Function</p>	<ul style="list-style-type: none"> <li>● LBS</li> <li>●</li> </ul>	<ul style="list-style-type: none"> <li>● LBS</li> <li>● GPS</li> </ul>
<p>3/17/2005</p>	<p>Etc</p>	<ul style="list-style-type: none"> <li>● WI-FI In restaurant</li> </ul>	<ul style="list-style-type: none"> <li>● WIMAN in town</li> </ul> <p>32</p>





Target Environment		
	<b>Goals</b>	<ul style="list-style-type: none"> <li>● Provide a bus line information via Mobile Phone when people want to use bus</li> <li>● Provide a bus arrival time when people want to know</li> </ul>
	<b>Ambient Information</b>	<ul style="list-style-type: none"> <li>● Line info service</li> <li>● Bus arrival time notification service</li> </ul>
<b>Device</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Smart Phone</li> <li><input type="checkbox"/> PDA, Mobile</li> </ul>	<b>Basic Function</b>	<ul style="list-style-type: none"> <li>● Context gathering capabilities</li> <li>● Context classification/transformation capabilities</li> <li>● Context discovery &amp; transfer capabilities</li> </ul>
<b>Network</b> <ul style="list-style-type: none"> <li>Wireless LAN</li> <li><input type="checkbox"/> Wi-Fi (802.11)</li> <li><input type="checkbox"/> WiMAX</li> </ul>	<b>Extension Function</b>	<ul style="list-style-type: none"> <li>● LBS</li> <li>● GPS</li> </ul>
	<b>Etc</b>	<ul style="list-style-type: none"> <li>● WiMAX</li> </ul>

# Subway

## Application 1 News delivery

## Application 2 Friend finder service

Target Environment		Application 1 News delivery	Application 2 Friend finder service
	<b>Goals</b>	<ul style="list-style-type: none"> <li>● Provide news that people are interested in via Mobile Phone</li> </ul>	<ul style="list-style-type: none"> <li>● Find a friend in the same subway</li> </ul>
	<b>Ambient Information</b>	<ul style="list-style-type: none"> <li>● Location information</li> <li>● Tag Interface</li> </ul>	<ul style="list-style-type: none"> <li>● Location information</li> <li>● Tag Interface</li> </ul>
<b>Device</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Smart Phone</li> <li><input type="checkbox"/> PDA/ Notebook</li> </ul>	<b>Basic Function</b>	<ul style="list-style-type: none"> <li>● Context gathering capabilities</li> <li>● Context classification/transformation capabilities</li> <li>● Context discovery &amp; transfer capabilities</li> </ul>	<ul style="list-style-type: none"> <li>● Context gathering capabilities</li> <li>● Context classification/transformation capabilities</li> <li>● Context discovery &amp; transfer capabilities</li> </ul>
<b>Network</b> <ul style="list-style-type: none"> <li>Wireless LAN</li> <li><input type="checkbox"/> Special microwave</li> <li><input type="checkbox"/> WiMAX</li> </ul>	<b>Extension Function</b>	<ul style="list-style-type: none"> <li>● LBS</li> <li>● GPS</li> </ul>	<ul style="list-style-type: none"> <li>● LBS</li> <li>● GPS</li> </ul>
	<b>Etc</b>	<ul style="list-style-type: none"> <li>● tool kit development for PDA to display Augmented Information</li> </ul>	

Train/Bus/Aircraft

Application 1  
Region Information

Application 2  
Reservation service

Target Environment

Device  Smart Phone  
 PDA/ Notebook

Network  Wireless LAN  
 Wi-Fi (802.11)  
 WiMAX, WiBro

Goals

- Provide a general region information for traveler

- Ticket searching service from departure to destination station

Ambient Information

- Location information

- Location information
- Tag Interface

Basic Function

- Context gathering capabilities
- Context classification/transformation capabilities
- Context discovery & transfer capabilities

- Context gathering capabilities
- Context classification/transformation capabilities
- Context discovery & transfer capabilities

Extension Function

- LBS
- GPS

- LBS
- GPS

Etc

- Region information such as sale, coupon, event and weather condition are gathered

- Provide remaining seat information and reservation service



Application 1  
Ship Management Service

Application 2  
Rescue service for a ship in distress

Target Environment		Application 1 Ship Management Service	Application 2 Rescue service for a ship in distress
	Goals	<ul style="list-style-type: none"> <li>● Provide a ship management service to a port via Mobile Devices</li> </ul>	<ul style="list-style-type: none"> <li>● Provide a rescue service for a ship in distress via Mobile Devices</li> </ul>
Device <input type="checkbox"/> Smart Phone <input type="checkbox"/> PDA/ Notebook	Ambient Information	<ul style="list-style-type: none"> <li>● Ship information (departure &amp; entry schedule of a ship, or a permission information, etc..)</li> </ul>	<ul style="list-style-type: none"> <li>● Location information (location of a wrecked ship)</li> </ul>
Network Wireless Environment <input type="checkbox"/> Wi-Fi (802.11) <input type="checkbox"/> WiMAX	Basic Function	<ul style="list-style-type: none"> <li>● Context gathering capabilities</li> <li>● Context classification / transformation capabilities</li> <li>● Context discovery &amp; transfer capabilities</li> </ul>	<ul style="list-style-type: none"> <li>● Context gathering capabilities</li> <li>● Context classification / transformation capabilities</li> <li>● Context discovery &amp; transfer capabilities</li> </ul>
	Extension Function	<ul style="list-style-type: none"> <li>● LBS</li> <li>● GPS</li> </ul>	<ul style="list-style-type: none"> <li>● LBS</li> <li>● GPS</li> </ul>
3/17/2005	Etc		<ul style="list-style-type: none"> <li>● Support auto emergency call</li> </ul> 36

# Cruise Ship

## Application – Ambient Tour Guide Service

### Target Environment

#### Device

- Smart Phone
- PDA/ Notebook

#### Network

- Wireless Environment
- Wi-Fi (802.11)
  - WiMAX

#### Goals

- Provide an ambient tour guide service via Mobile Devices

#### Ambient Information

- Location information (Hotel, Restaurant, etc information near by terminals)
- Schedule information (schedule, reservation, etc..)

#### Basic Function

- Context gathering capabilities
- Context classification / transformation capabilities
- Context discovery & transfer capabilities

#### Extension Function

- LBS
- GPS

#### Etc

- Support seamless & real-time services

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# Highway

## Application 1 Highway Information Service

## Application 2 Emergency Service

Target Environment		Application 1 Highway Information Service	Application 2 Emergency Service
	<b>Goals</b>	<ul style="list-style-type: none"> <li>● Provide a synthetic highway information via Mobile Devices</li> </ul>	<ul style="list-style-type: none"> <li>● Provide a safety service for emergence situation in the highway via Mobile Phone</li> </ul>
<b>Device</b> <input type="checkbox"/> Smart Phone / PDA <input type="checkbox"/> Private Devices for Telematics	<b>Ambient Information</b>	<ul style="list-style-type: none"> <li>● Location information (gas station, rest, toll-gate, etc..)</li> <li>● Highway-traffic Information</li> <li>● <del>Tag Information</del></li> </ul>	<ul style="list-style-type: none"> <li>● Location information</li> <li>● car trouble information</li> </ul>
<b>Network</b> Wireless & Fast Mobile Environment <input type="checkbox"/> WiMAX	<b>Basic Function</b>	<ul style="list-style-type: none"> <li>● Context gathering capabilities</li> <li>● Context classification / transformation capabilities</li> <li>● Context discovery &amp; transfer capabilities</li> </ul>	<ul style="list-style-type: none"> <li>● Context gathering capabilities</li> <li>● Context classification / transformation capabilities</li> <li>● Context discovery &amp; transfer capabilities</li> </ul>
	<b>Extension Function</b>	<ul style="list-style-type: none"> <li>● LBS</li> <li>● GPS</li> </ul>	<ul style="list-style-type: none"> <li>● LBS</li> <li>● GPS</li> </ul>
	<b>Etc</b>		<ul style="list-style-type: none"> <li>● Support auto diagnosis and emergency call</li> </ul>

# Travel

## Application – Travel Guide Service

### Target Environment

#### Device

- Smart Phone
- PDA/ Notebook

#### Network

- Wireless & Fast Mobile Environment
- WiMAX

#### Goals

- Provide a Travel Guide Service via Mobile Devices

#### Ambient Information

- Travel path information
- Traffic Information
- General travel information (accommodation / reservation)

#### Basic Function

- Context gathering capabilities
- Context classification / transformation capabilities
- Context discovery & transfer capabilities

#### Extension Function

- LBS
- GPS

#### Etc

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City coming in car

### Application 1

DMB service without satellite receive antenna

#### Target Environment

##### Device

- Smart Phone
- PDA/ Notebook
- CAR
- HDTV signal receive Antenna

##### Network

- Wireless LAN
- Wi-Fi (802.11)
  - WiMAX
  - Satellite network

##### Goals

- Provide DMB service without satellite receive antenna

##### Ambient Information

- Location information
- DMB service

##### Basic Function

- Context gathering capabilities
- Context classification/transformation capabilities
- Context discovery & transfer capabilities

##### Extension Function

- DMB receive antenna needs to transform DMB signal to signal possible to can receive to cell phone.

##### Etc

- Car must have DMB receive antenna.

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Globe

Application 1  
Mobile Grid supporting middleware

Target Environment

Device

- Smart Phone
- PDA/ Notebook

Network

- Iridium Satellite System
- Teledesic
- Globalstar
- 3G,4G, and cell netarok

Goals

- Provide a API & SDK to support common application interface in distributed system

Ambient Information

- Database
- Computing resource

Basic Function

- Context gathering capabilities
- Context classification/transformation capabilities
- Context discovery & transfer capabilities

Extension Function

- Heterogeneous network integration function
- LBS
- GPS
- TMO for Real-time function invocation

Etc

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