

# Technology, Innovation, Education

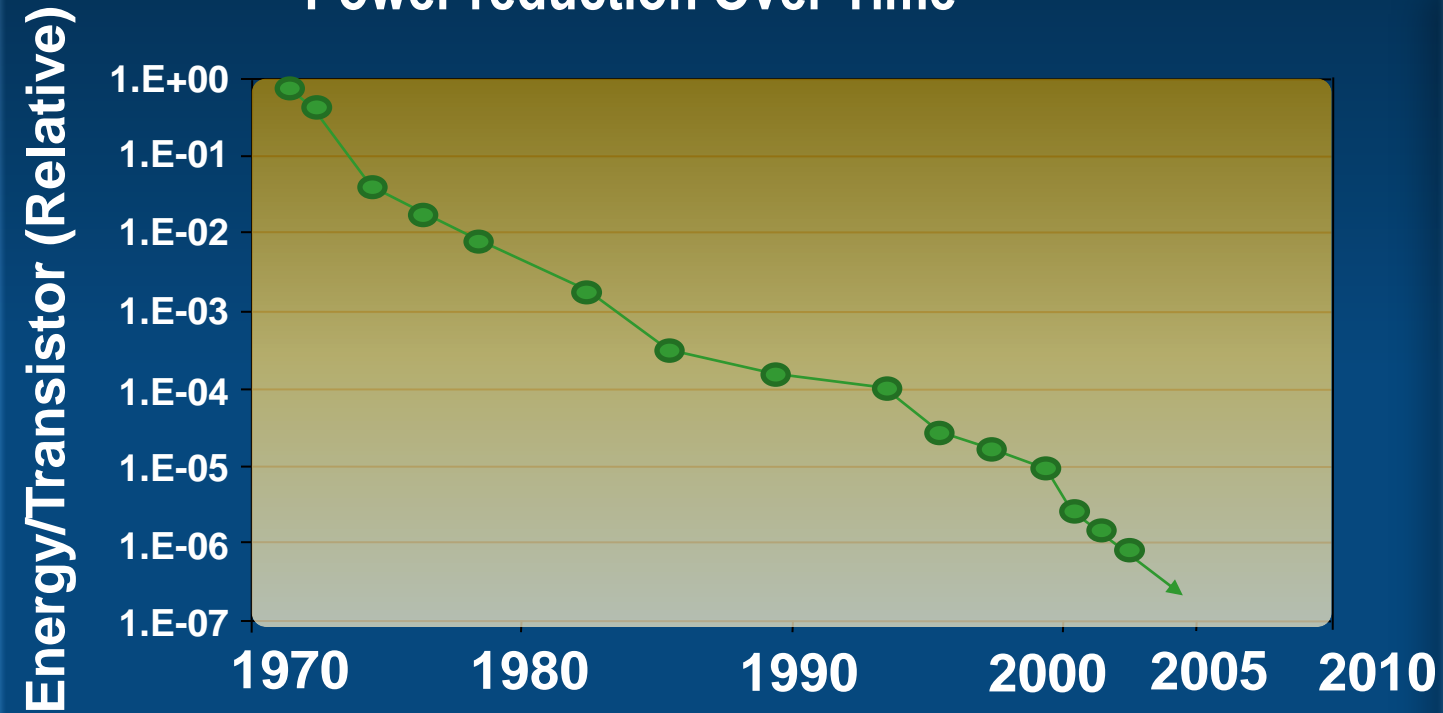
*Igniting sustainable opportunities for the billions*

Priyadarsan Patra  
SEEDS & Intel Corp.

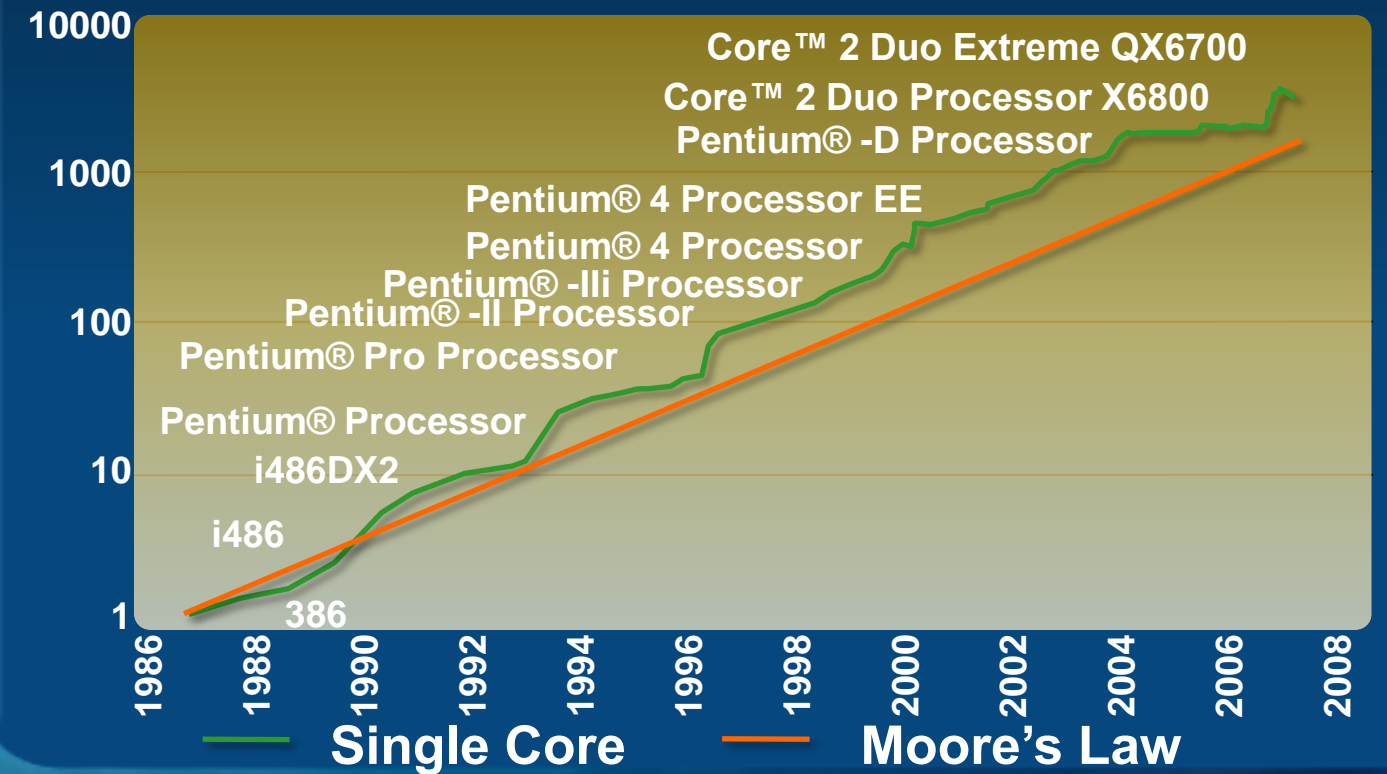


# (1) Continuum of Transistor Performance and Power

Power reduction Over Time\*



Core Integer Performance Over Time

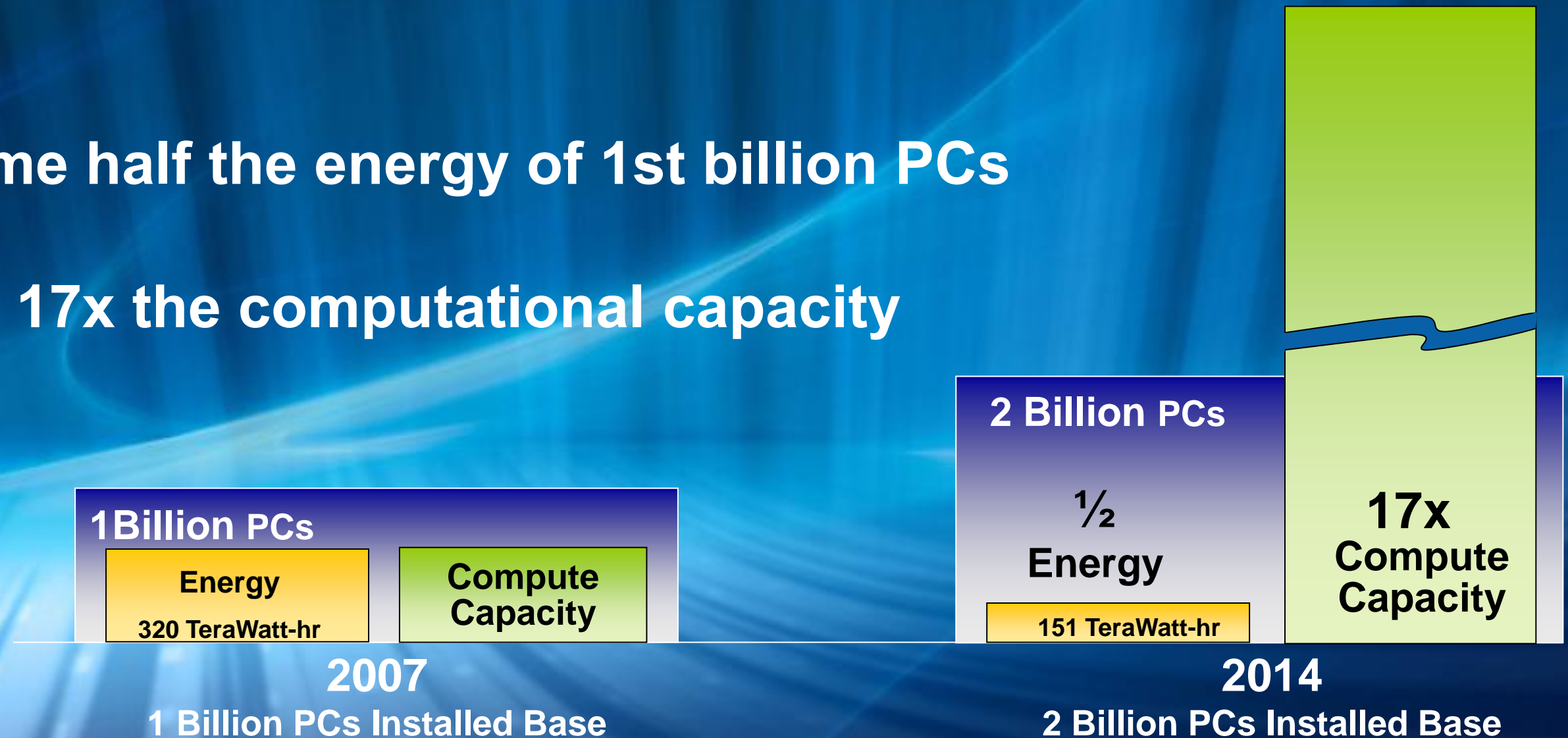


~ 1 Million Factor Reduction In Energy/Transistor Over 30+ Years Delivering  
Great Performance Within Power Envelope  
Compute Energy Efficiency → Positive Impact On Environment

# COMPARED TO THE FIRST BILLION PCs INSTALLED THE NEXT 2 CONNECTED BILLION PCs WILL...

...consume half the energy of 1st billion PCs

...deliver 17x the computational capacity



Source: Intel Microprocessor Marketing and Business Planning

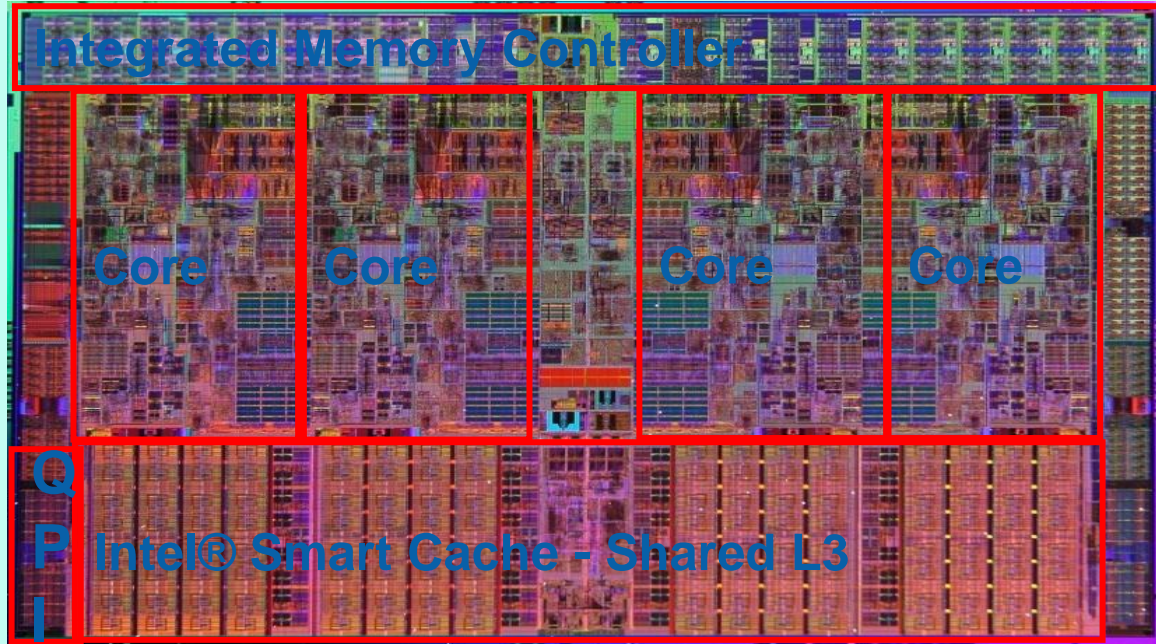


## (2) Computing Device Continuum





# Example : Industry's First Dynamically Scalable Microarchitecture



**Nehalem-EP**

## Performance/Features:

Up to 4 cores with On-chip Shared Cache

**Intel® QuickPath Interconnect**

**Intel® Turbo Boost Technology**

**Integrated Memory Controller**

Intel Hyper-Threading Technology

New multi-media and RMS Instructions

Fully Unlocks Intel 45 nm High-k Silicon Benefits

**Delivering the Next Generation of Energy Efficient Performance**

# Explosion of Internet Growth & Services

## Today

### More Users

Only 25% of the world is Internet connected today<sup>1</sup>



### More Devices

~80% of Internet connected devices are computers & phones<sup>3</sup>



### More Content

2.5B photos on Facebook<sup>4</sup>  
30B videos viewed/mos<sup>5</sup>  
Google indexes >1T pages<sup>6</sup>



## 2015

New technologies will connect over 1 billion additional users to the cloud<sup>2</sup>

Cars, TVs, households, etc. to increase connected devices up to 2.5x to >10 billion globally<sup>3</sup>

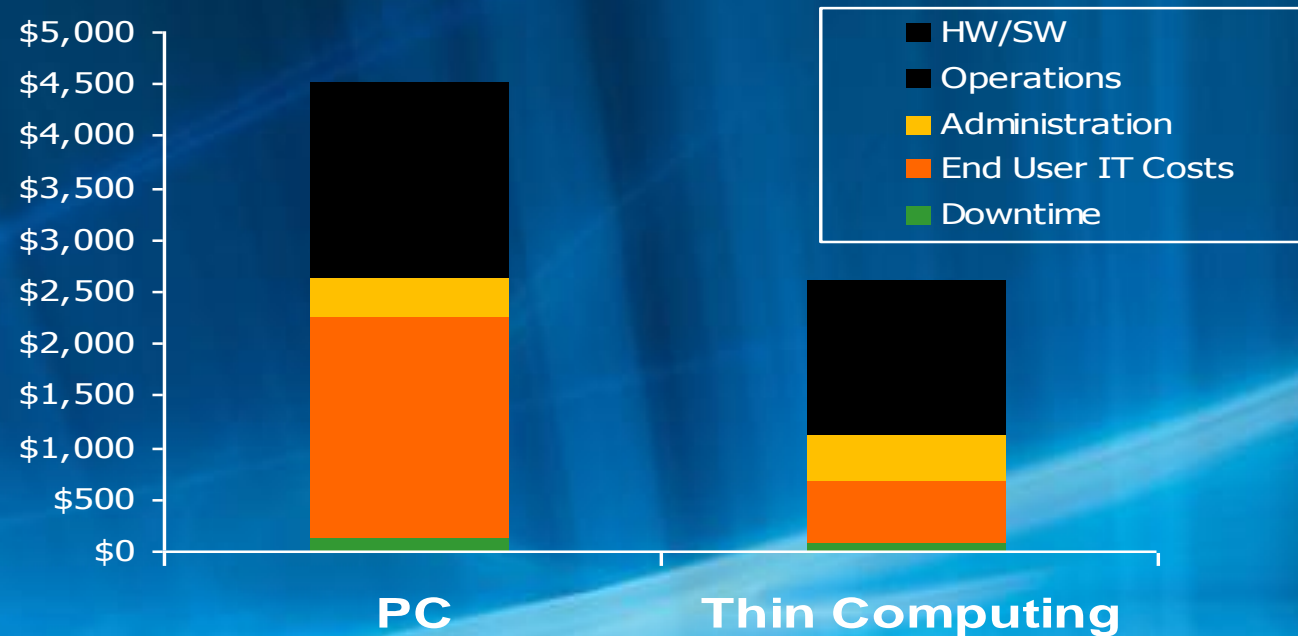
Up to 8X network, 16X storage & 20x compute capacity needed<sup>7</sup>

***What addresses the “bottom of the pyramid” billions?***



# Thin Computing Potential

## Cost Benefits



**40%**

Reduction  
HW and SW  
costs

**29%**

Reduction  
IT operations  
costs

**88%**

Reduction  
worker  
downtime

**78%**

Increase  
IT staff  
productivity

**Business Benefits**

**Security / Privacy**

**Compliance**

**Manageability**

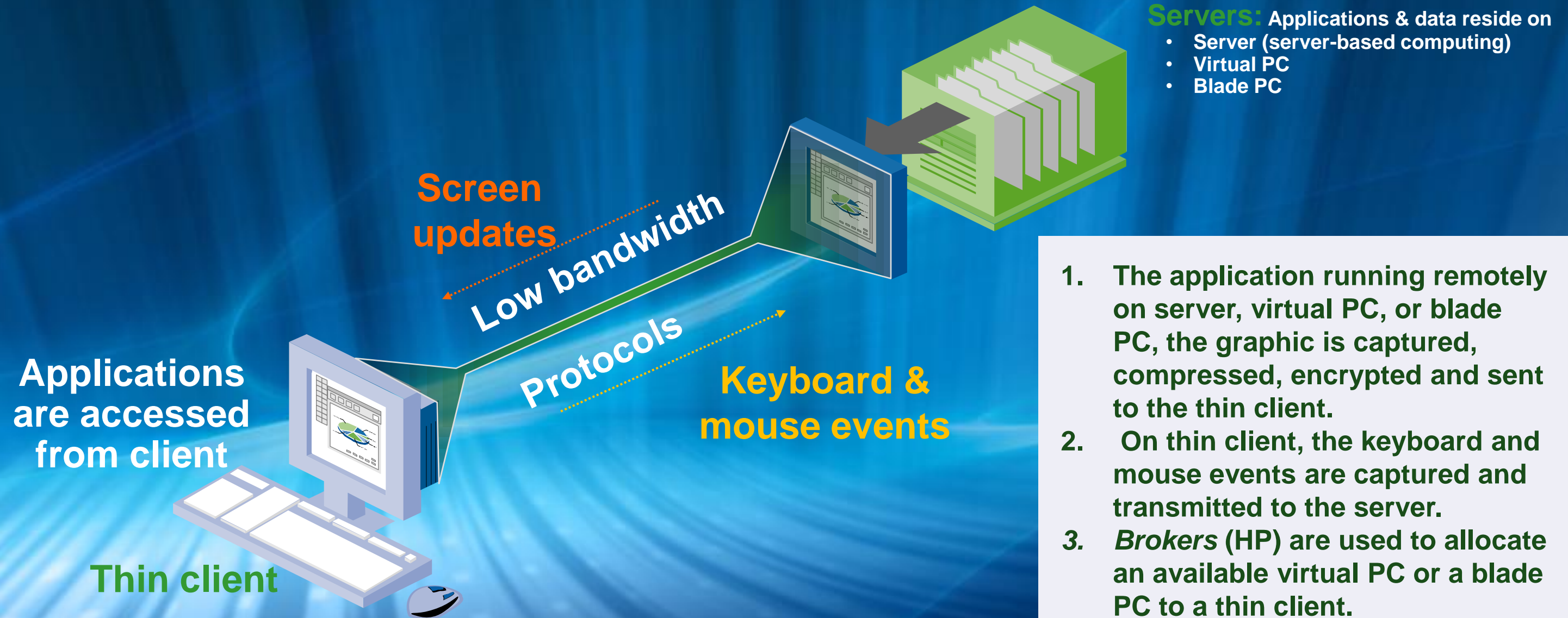
**Reliability**

**Rapid Deployment**

**Power/Noise/Cooling**

Source: Gartner Inc (8/05), IDC (11/05), and Wyse Estimates

# Thin Clients in a Virtualization Environment





# IT Challenges Faced by Business, Government and Organizations

## Compliance and Security

Need for  
preventative/proactive measures

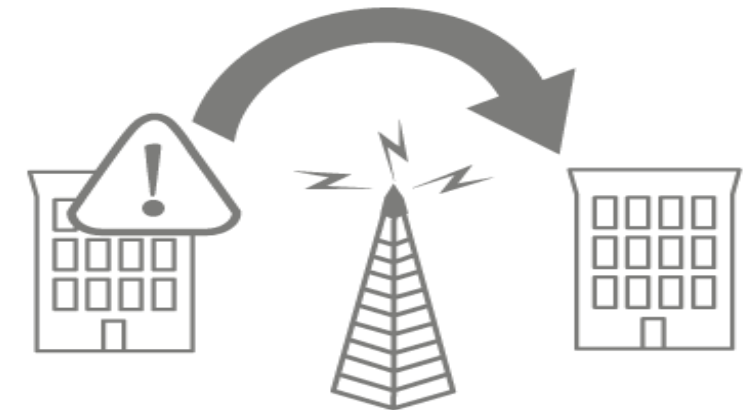


Data theft  
Virus/malware  
Phishing  
Hacking

## Outsourced and offshore teams



## Business continuity and disaster recovery



## Diverse Workforce



Office  
Corporate office  
Working from home  
Mobile employee

## Heterogeneous hardware



Desktops  
Laptops  
Multiple vendors  
Different refresh cycles

## Go green



# Characteristics of clouds

**Characteristic:** Enterprises incur no infrastructure capital costs, just operational costs incurred on a pay-per-use basis, with no contractual obligations

**Characteristic:** Architecture specifics are abstracted. Run in multi-tenancy mode with multiple users accessing simultaneously

**Definition:** Clouds are hardware-based services offering compute, network and storage capacity where:

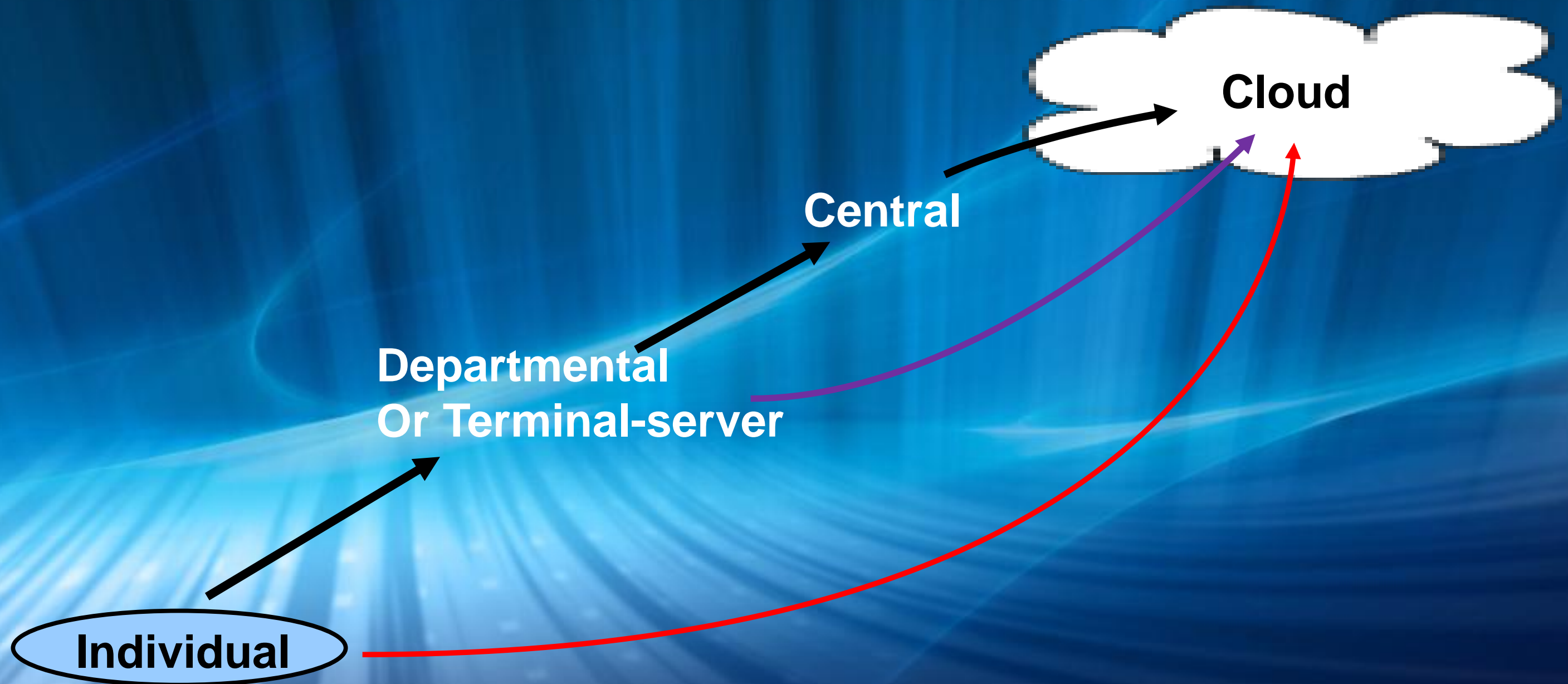
- 1 Hardware management is highly abstracted from the buyer
- 2 Buyers incur infrastructure costs as variable OPEX
- 3 Infrastructure capacity is highly elastic (up or down)

**Characteristic:** Capacity can be scaled up or down dynamically, and immediately,

**Characteristic:** The underlying hardware can be anywhere geographically



### (3) Infrastructure Continuum: IT priesthood to Consumer Computing



# Cloud Computing – Benefits

- Reduce capital expenditures
- Low barrier to entry
- Scalable infrastructure
- Cost-effective – Pay for what you use
- Acquire resources on demand
- Release resources when not needed
- Virtually infinite compute and storage resources
- Turn organization's fixed cost into variable cost
- *May* improve security
- Professional Patch management and managed services



# Intel Cloud 2015 Vision

**Federated**  
*Data and services  
seamlessly and  
securely span clouds*



**Automated**  
*Dynamically allocates  
resources to manage  
service level and  
optimize power*



**Client Aware**  
*Secure access and optimal  
experience across the client  
continuum*



Desktops   Laptops   Netbooks



Personal  
Devices



Smartphones



Smart TVs



Embedded



# Computing for the Masses (CFM 2005-06)

[www.seedsnet.org](http://www.seedsnet.org)



# Reasons for the CFM

- Uneven diffusion of the Information and Communication Technologies (ICT) has caused a “digital divide”
- Education as development leapfrogging : IT export alone is >8% of India's GDP growth
- CFM induces efficiency and innovation
  - Brings a world of information to the under-served
  - Induces governmental transparency
  - Automated and cost-effective search for prices, labor or employment opportunities; Easy access to details of govt. programs for citizens
- Flattens the world of “information barriers”
- Enables new forms of income generation for the economically backward:
  - “learn-type-earn”, computer-assisted tutoring, automated bookkeeping
  - desktop publishing/typesetting, printing of invitation cards or handbooks (Oriya or English), and Blog Management for news organizations, etc.

# Our Target District at a Glance

- Bottom of the pyramid..
- Gajapati District is spread over an area of 4444 Sq. Kms. has 60% high land, 25% medium and rest 15% low land.
  - Borders Andhra Pradesh to the south, and Orissa's Ganjam dist. to the north
- Population as per 2001 census is 5,18,448 -- females outnumbering males by 3%
- Literacy rate is only 41.73% with female literacy being at 28.91%.
- 33% of population has income under Rs. 4000/year – “destitute” category
- More than 50% of the population belong to scheduled tribes.
- The school drop out rate for Orissa itself is over 88%
  - For the year 2005-06, the district had the worst pass percentage in all of Orissa in class X as well as class XII examinations.



# Technological Basis of CfM

- *Terminal computing* is using a back-end server computer to power a network of cheap client terminals, with following advantages:
  - Open-source software running centrally on server
  - Reduced hardware costs and maintenance
  - A veritable “lab” for the student tinkers & thinkers
- The ingredients of such a system
  - Fedora K12LTSP software bundle; one capable cpu/PC
  - 4 to 8 X-terminals or old/discarded office computers
  - 1 GB RAM; 30+ GB Hard disk; some reliable power supply
  - Two 100/base cards and router for intra- and internet access
  - The human capital: Self-help group of school mentees & college mentors



# System Test and Adaptation

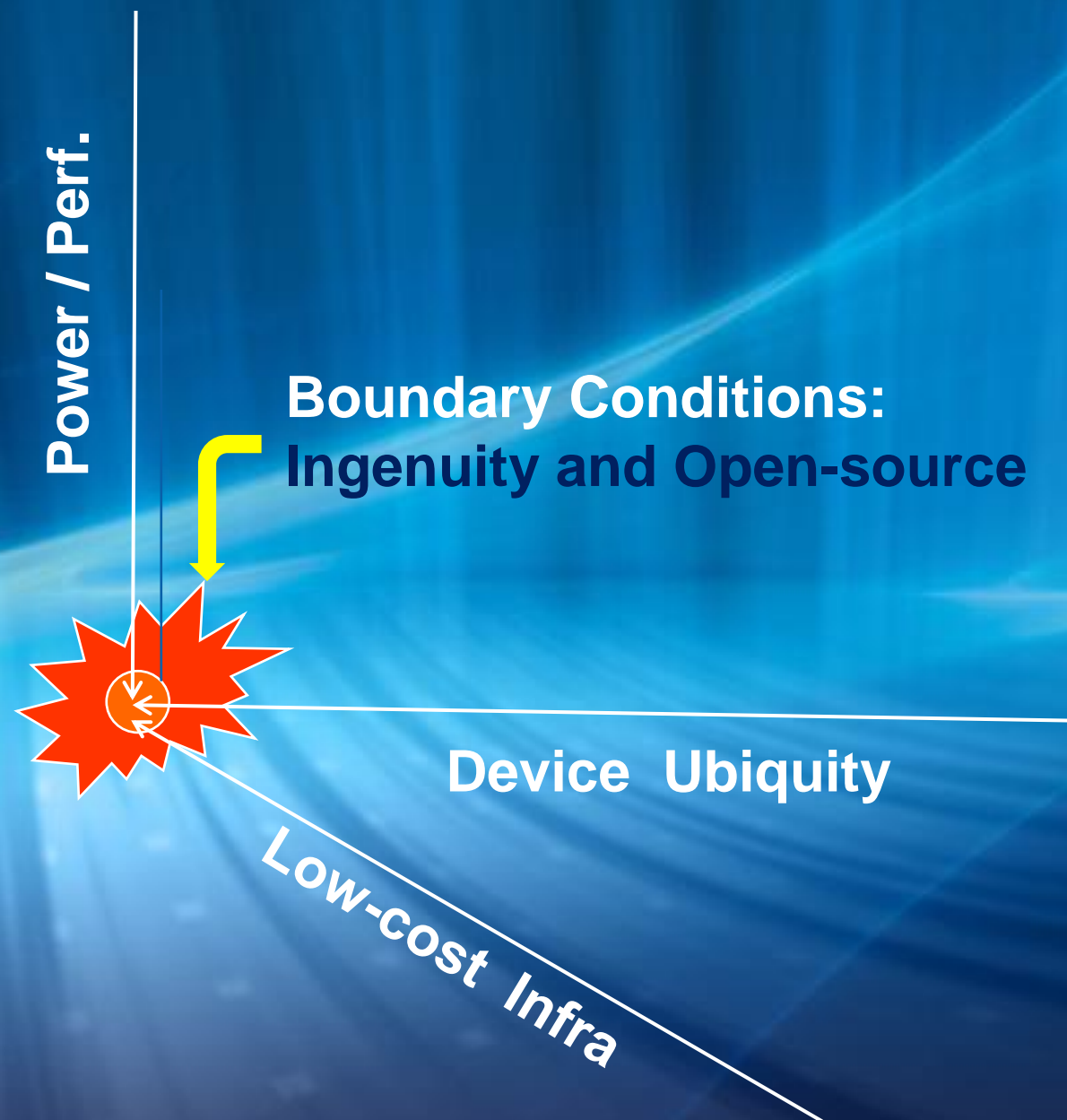


On-site visit with our host technical collaborators  
at JITM

System Deployment Cost Breakdown	
Computer and other hardware	Rs. 38,580/-
Electrification	Rs. 1843/-
Sign Board	Rs. 450/-
Transport and Installation	Rs. 4500/-
Miscellaneous	Rs. 683/-
<b>TOTAL</b>	<b>Rs. 46056/-</b>



# *Birth of Sustainable Opportunities for the Billions*



# Open Source! --some milestones

- 1970s: UNIX operating system developed at Bell Labs with contributors outside of the Labs; later AT&T enforces intellectual property rights and “closes” the code
- 1983: Richard Stallman founds the Free Software Foundation
- 1993: Linus Torvalds releases first version of Linux built
- 1997: Debian Free Software Guidelines released
- 1998: Netscape releases Navigator with source
- 2000: OpenOffice by Sun



# Examples of open source software

- Internet

- Apache, which runs over 50% of the world's web servers.
- BIND, the software that provides the DNS (domain name service) for the entire Internet.
- Sendmail, the most important and widely used email transport software on the Internet.
- Mozilla, the open source redesign of the Netscape Browser
- OpenSSL is the standard for secure communication

- Tools, Languages

- Perl, Python, Tcl/Tk; GCC, Make, Autoconf; Zope, PHP; etc.

# Open source software sites

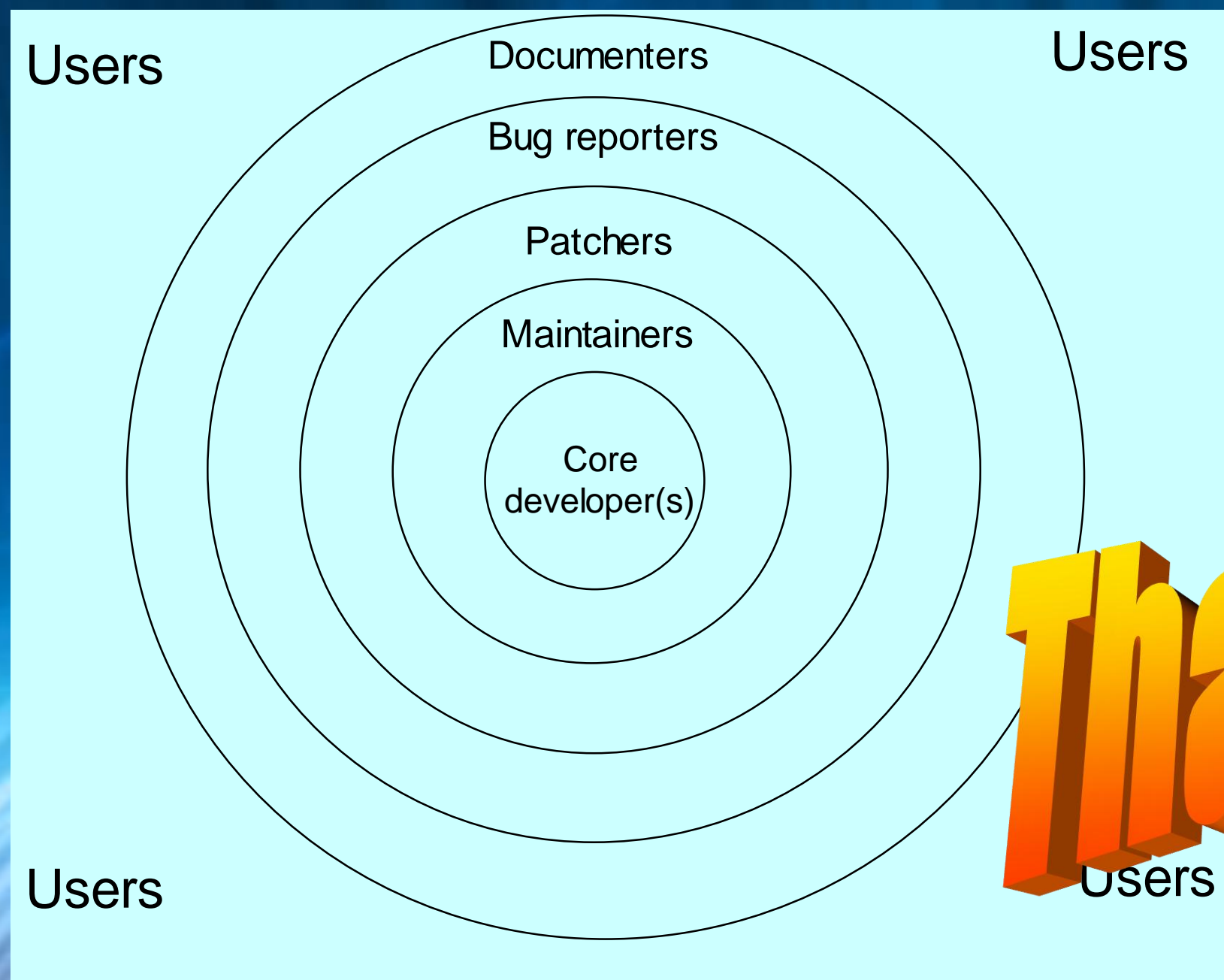
- Free Software Foundation [www.fsf.org](http://www.fsf.org)
- Open Source Initiative [www.opensource.org](http://www.opensource.org)
- Freshmeat.net
- SourceForge.net
- OSDir.com
- developer.BerliOS.de
- Bioinformatics.org
- [www.apache.org](http://www.apache.org) or [www.cpan.org](http://www.cpan.org) etc.



# A Few Open-Source Project Ideas

- EduTainment Software
- Windows Terminal Services Clone
- New Desktop / Microcontent Client / Web Services Browser
- Social Software: Blogs, Wikis, People Networks
- Local Language Software and Applications
- RSS-based Information Marketplace
- Outsourced Linux Support / Development Centre
- Open Office Call / Support Centre
- Tool for Business Applications and Process Management
- Open Source VLSI (for another day)

# Open source software development



**Thank you!**