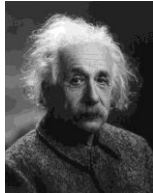# Paradigm Shifts in P2P

See-Mong Tan

Microsoft

Paradigm Shifts in Physics

"God does not play dice with the universe"
- Albert Einstein

Aristotle

Classical physics

Newton

Mechanics

Einstein

Relativity

Heisenberg, Schrodinger, et. al
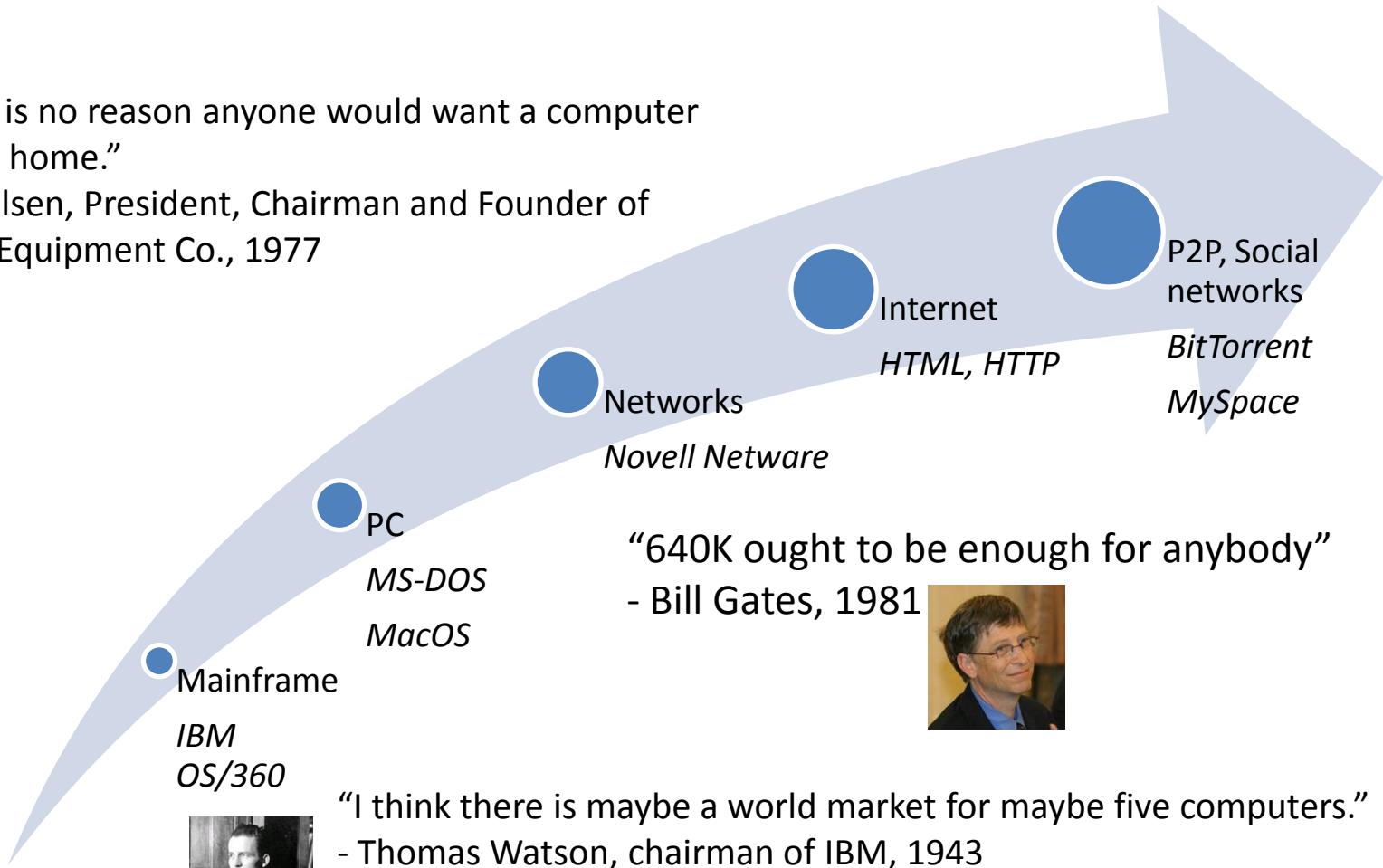
Quantum mechanics

"Not only does God play dice, but... he sometimes throws them where they cannot be seen."
- Stephen Hawking

Paradigm Shifts in Information Technology

"There is no reason anyone would want a computer in their home."
- Ken Olsen, President, Chairman and Founder of Digital Equipment Co., 1977

P2P, Social networks

BitTorrent

MySpace

Internet

HTML, HTTP

Networks

Novell Netware

PC

MS-DOS

MacOS

"640K ought to be enough for anybody"
- Bill Gates, 1981

Mainframe

IBM
OS/360

"I think there is maybe a world market for maybe five computers."
- Thomas Watson, chairman of IBM, 1943

Elements of New Paradigms

- When enough significant anomalies have accrued against a current paradigm, the prevailing discipline is thrown into a state of *crisis**

   "A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die, and a new generation grows up that is familiar with it."
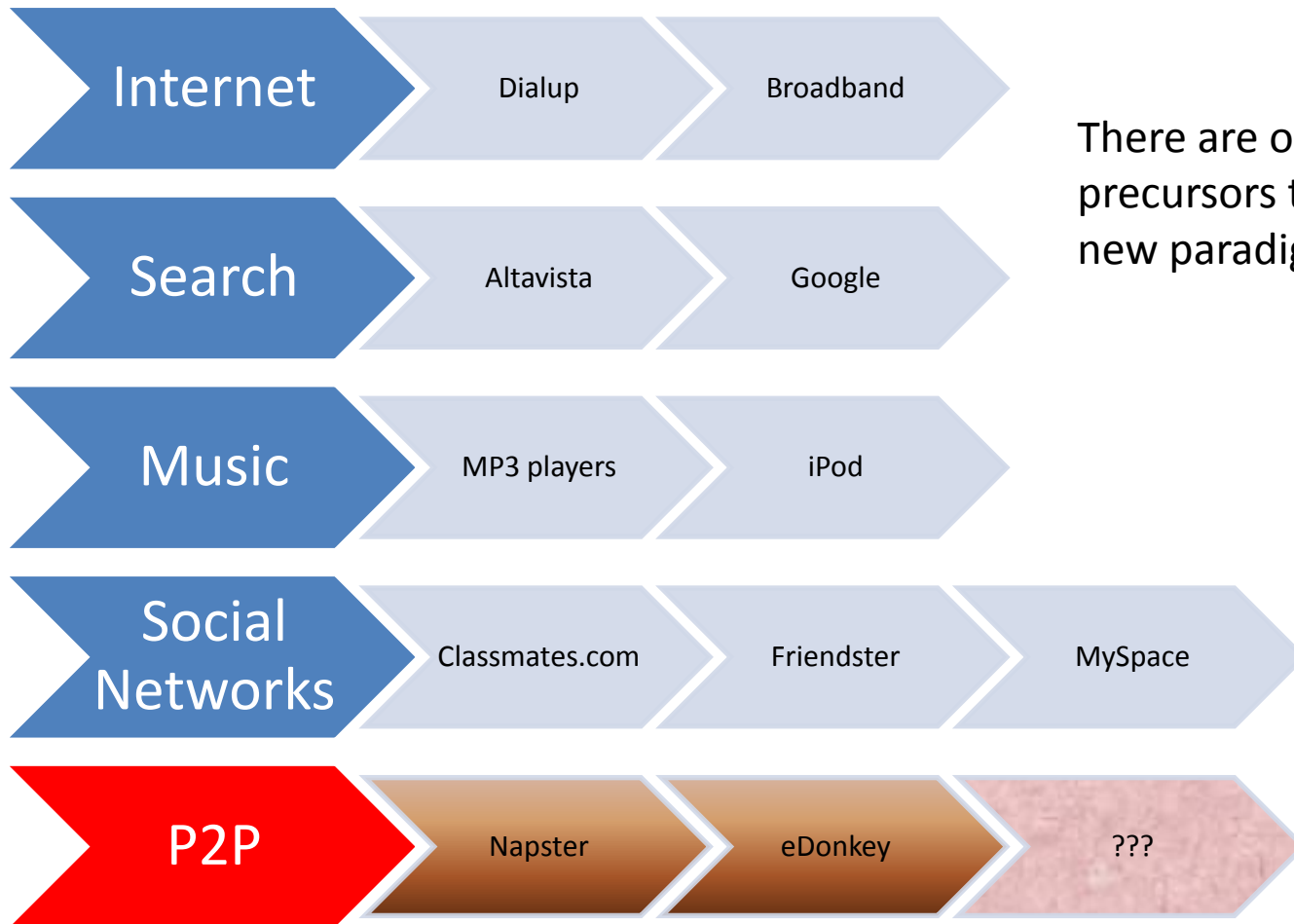

   - Max Planck

- Paradigm shifts are hard to foresee when you're living in the old world
- Complacency relegates companies to dinosaur status
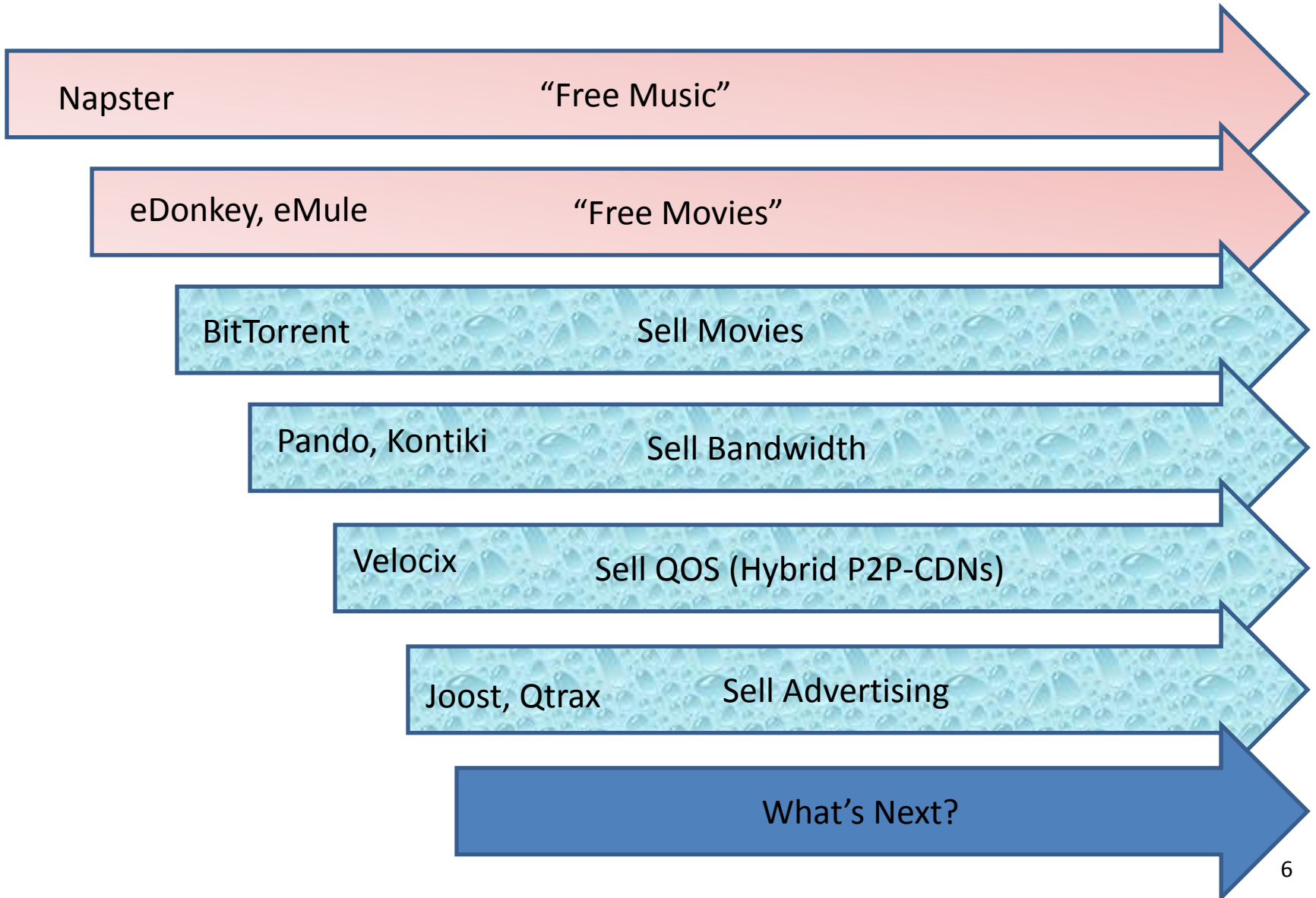- Constant innovation is necessary to survive

* Thomas Kuhn, *Structure of Scientific Revolutions*, University of Chicago Press, 3rd Edition, 1993.

Limited Crystal Ball Gazing is Possible

Internet	Dialup	Broadband	
Search	Altavista	Google	
Music	MP3 players	iPod	
Social Networks	Classmates.com	Friendster	MySpace
P2P	Napster	eDonkey	???

There are often precursors to successful new paradigms

Evolution of P2P Business Models

Napster	"Free Music"
eDonkey, eMule	"Free Movies"
BitTorrent	Sell Movies
Pando, Kontiki	Sell Bandwidth
Velocix	Sell QOS (Hybrid P2P-CDNs)
Joost, Qtrax	Sell Advertising
	What's Next?

Gedankenexperiment

- What is the next successful paradigm shift in P2P?
- A thought experiment:
  - Pick one scenario
  - Conjecture a business model that will change the whole game, based on *a priori* knowledge

- Scenario: P2P Video
  - Examining the existing landscape, some common features are:
    - **P2P** used to reduce delivery costs and reach scale
    - PC-based **consumer experience**
    - **Advertising** is the monetization vehicle
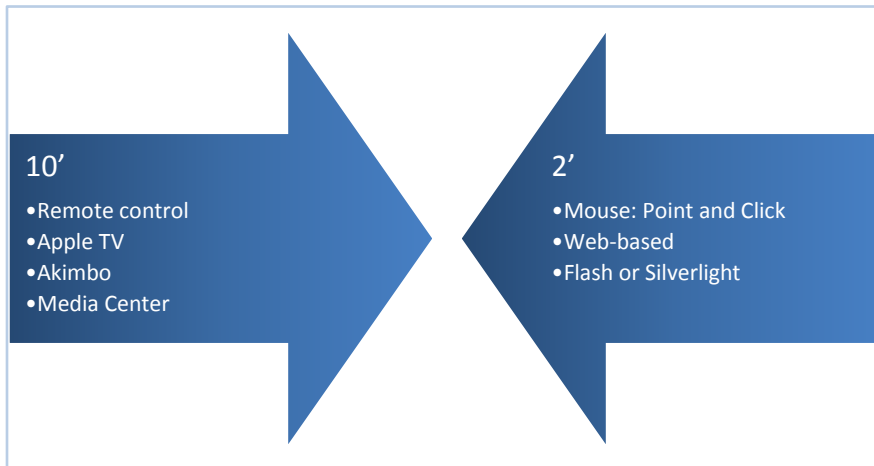   - Various types of **content**

P2P Networking

- Respects copyrights
- Collaborative protocols between P2P & ISPs
- Takes advantage of ubiquitous connectivity

Consumer Experience

- PC vs TV dichotomy
  - Will people watch video on their PCs?
  - Does a generational change have to happen?

10'	2'
•Remote control	•Mouse: Point and Click
•Apple TV	•Web-based
•Akimbo	•Flash or Silverlight
•Media Center	

SOURCE: Integrated Media Measurement Inc.

im▸mi

Integrated Media Measurement Inc.

Jul 17, 2007 11:00 ET

**Parents Set to Watch More Media Than Kids in 2007**

Study Shows Parents Spending More Time in Front of the Tube, Watching DVDs and Going to the Movies Than Kids

SAN MATEO, CA--(Marketwire - July 17, 2007) - It may be the parents telling their kids to stop watching so much television, but it's the parents who are glued to their TV sets, according to

- There are other devices like cell phones

- P2P as a central part of the experience

P2P Experiences

Knowledge sharing
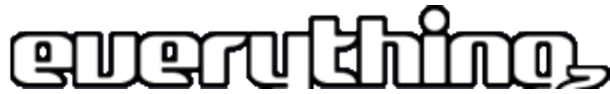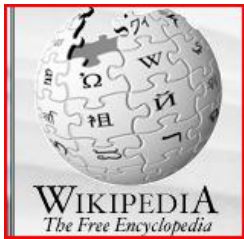
Compute sharing

Social networks

Content sharing

P2P Games
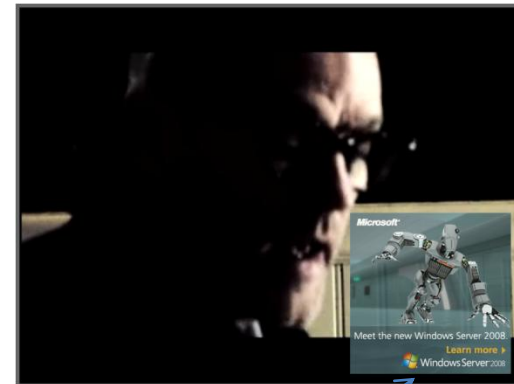

P2P Lending

Search sharing

Advertising

- Free is very appealing, and that's why most solutions gravitate toward it over subscriptions
- There is a lot of room for experimentation and improvement
- Advertising can and should go beyond the traditional 30s spot and present day TV ad loads
  - Companion units, Bugs, Click to continue, …
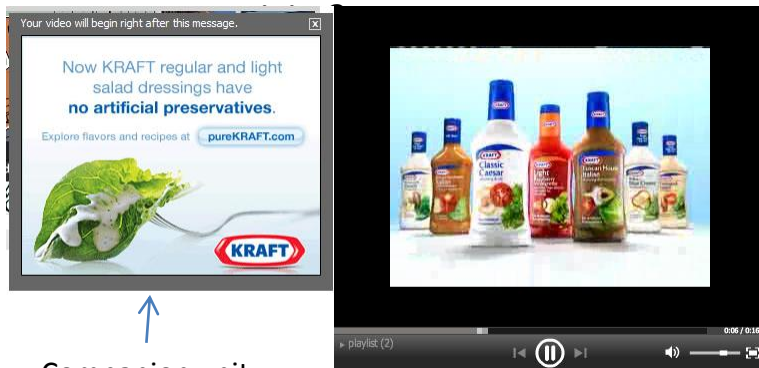

Companion unit

Bug

- After the initial flowering of experimentation – standardization is probably crucial
  - Ad industry won't scale to *laissez faire* chaos
  - Settle on a small set of standard ad formats
- Many opportunities in targeting and customization

Content

- Pareto Principle (80/20 rule):
    - 80% of the usage will derive from 20% of the content
    - Typically popular TV shows and movies
    - P2P works very well against head content
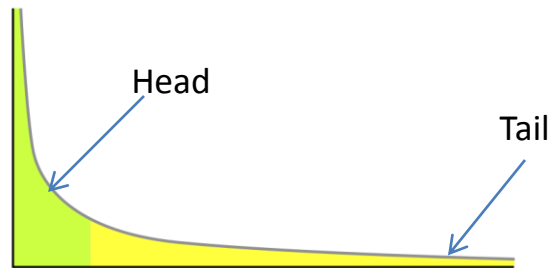
Vilfredo Federico Damaso Pareto

- Anderson Principle (The Long Tail):
    - Amazon, eBay, Google and YouTube all monetize the long tail
    - We can expect P2P video to have same attributes
    - Many sources
        - Smaller production houses, independent content
        - Peer produced content – anyone can publish (legitimate content), anyone can watch
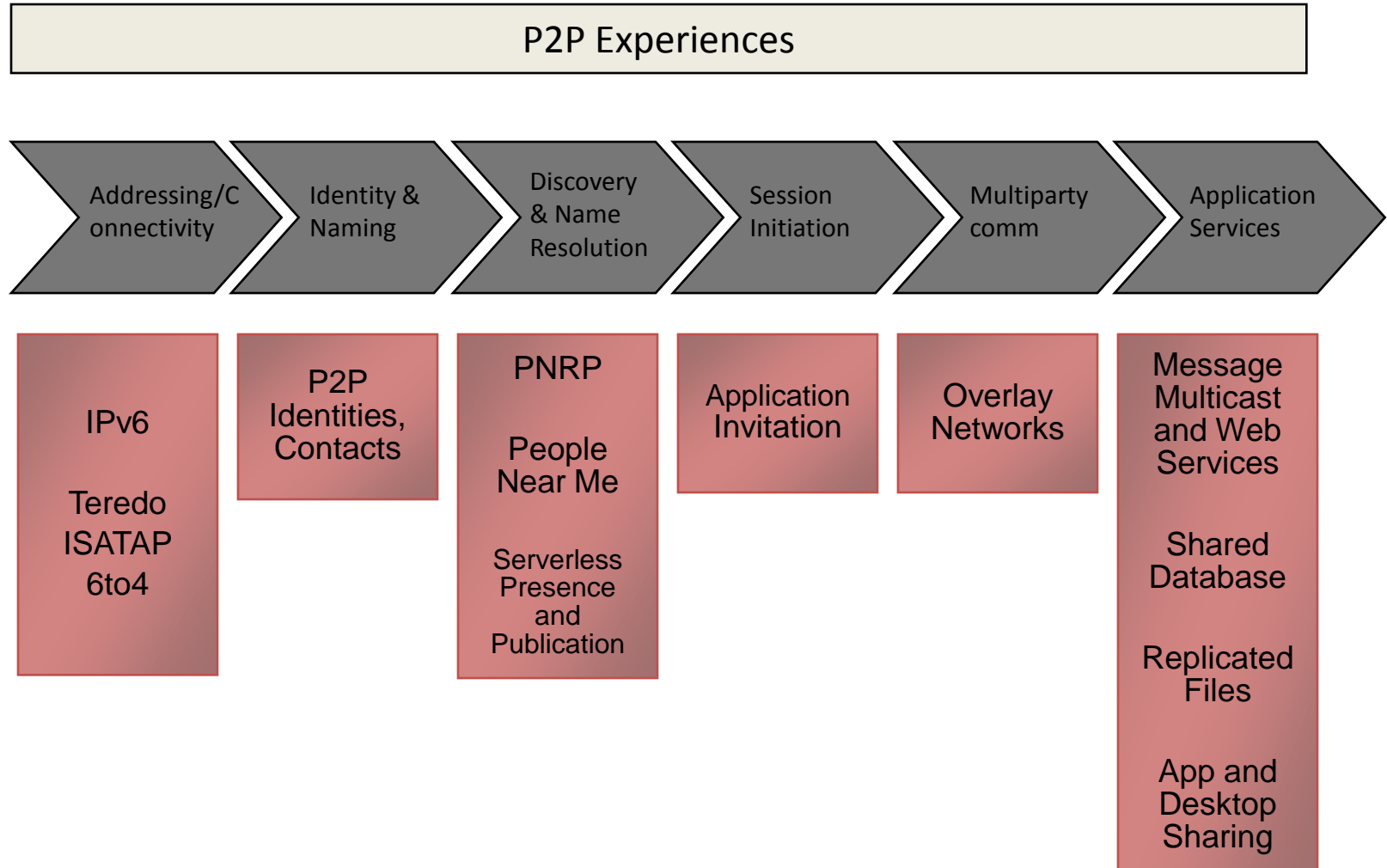   - P2P works poorly here – most systems may be hybrid P2P-CDN

Chris Anderson*

* Anderson, Chris (2006). *The Long Tail: Why the Future of Business Is Selling Less of More*. New York: Hyperion.

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The Next Big Thing?

- A new paradigm in P2P video could be:
  - A compelling **consumer experience** where P2P is a central part of the experience
  - (Small set of) new formats in **advertising**
  - Compelling **content,** including tail content
  - Likely a hybrid P2P-CDN system
  - Reaching a critical mass of users
- All of the above may be totally wrong (it'll be a new paradigm, after all), but it will be *cool.*

- The true heroes of this revolution are the entrepreneurs who will run the experiment for real
- They are the people in this room
  - My hat off to all of you

P2P Platform in Windows Vista

P2P Experiences

Addressing/Connectivity	Identity & Naming	Discovery & Name Resolution	Session Initiation	Multiparty comm	Application Services
IPv6 Teredo ISATAP 6to4	P2P Identities, Contacts	PNRP People Near Me Serverless Presence and Publication	Application Invitation	Overlay Networks	Message Multicast and Web Services Shared Database Replicated Files App and Desktop Sharing

BACKUP

Paradigm Shifts in Astronomy

Ptolemy

Geocentrism

Copernicus

Heliocentrism

Galileo & Kepler

Laws of planetary motion

Newton

Celestial dynamics

Hubble, Lemaitre

• *Big Bang*