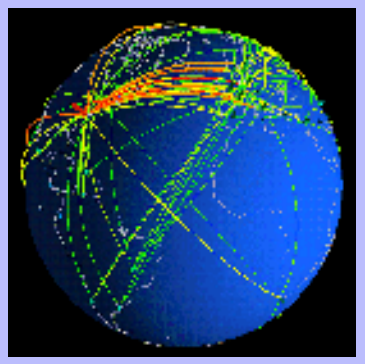
Telcordia Technologies

Beyond 4G Networks & Services

Adam T. Drobot
Telcordia Technologies, Inc.
Piscataway, NJ 08854



ISCC 2007:
12th IEEE Symposium on Computers and Communications

Aveiro, Portugal
3 July 2007

Agenda

- Introduction
- Background
- Technologies
- Future Directions

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Introduction

- The Communication Industry
  - Size – $2.7 Trillion worldwide, $0.9T U.S.
  - Complexity
    - Wireline, Wireless, Cable, Fiber, Satellite, Powerline…
    - Voice, Data, Video…
  - Pervasiveness – Global system with 1B+ subscribers
- Convergence
  - Delivery of any service over any device or network, to any location, using common infrastructure

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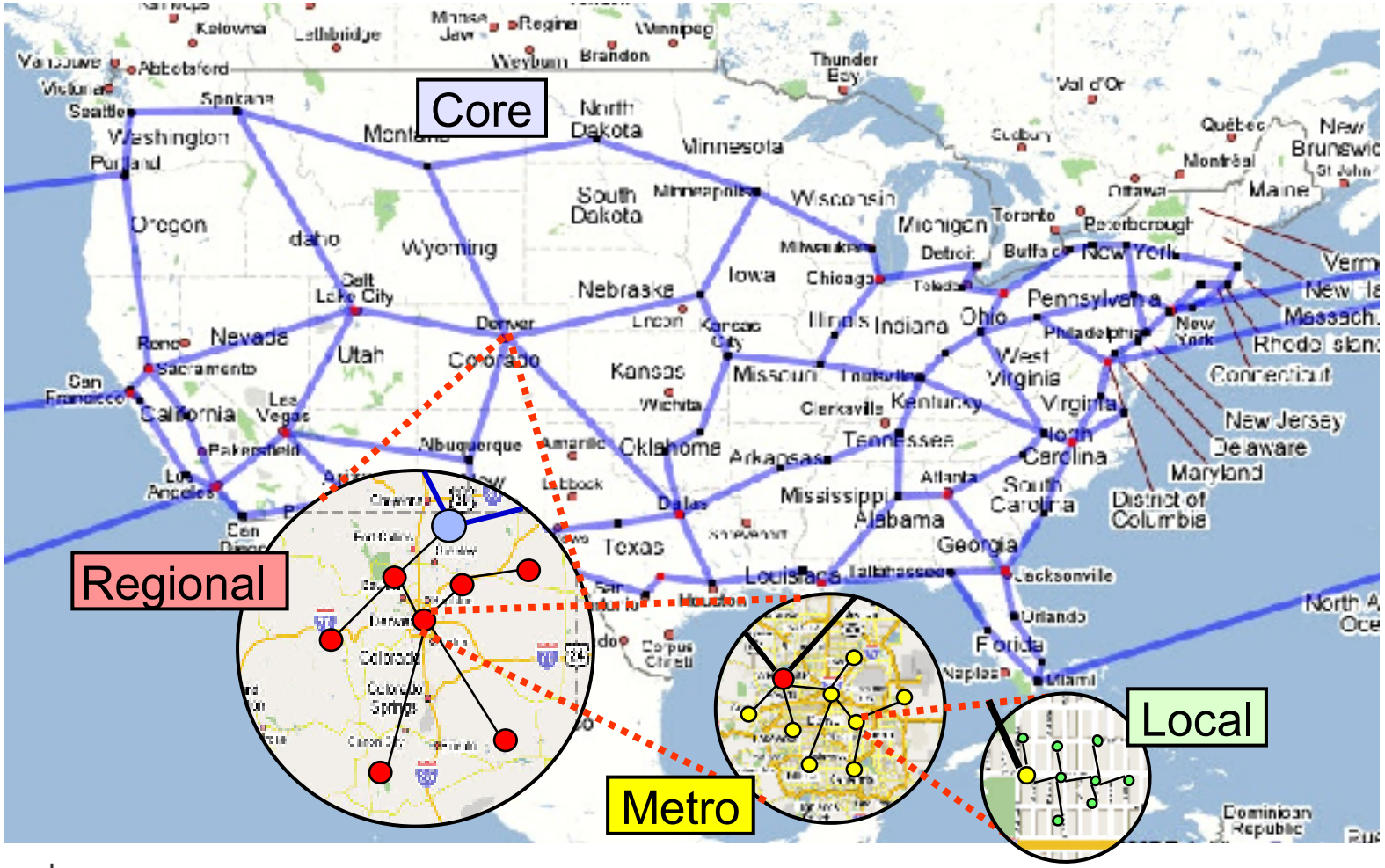
Introduction

Networks – Core, Regional, Metro, Local



Introduction

The Communication Industry

- Drivers
  - New Services
  - Efficiency of Operations
  - Deployment of Capital
- Direction
  - Applications and Services
  - IMS – IP Multimedia Subsystem
  - Mediating Middleware and Core Capabilities
  - Networks and Devices

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Background

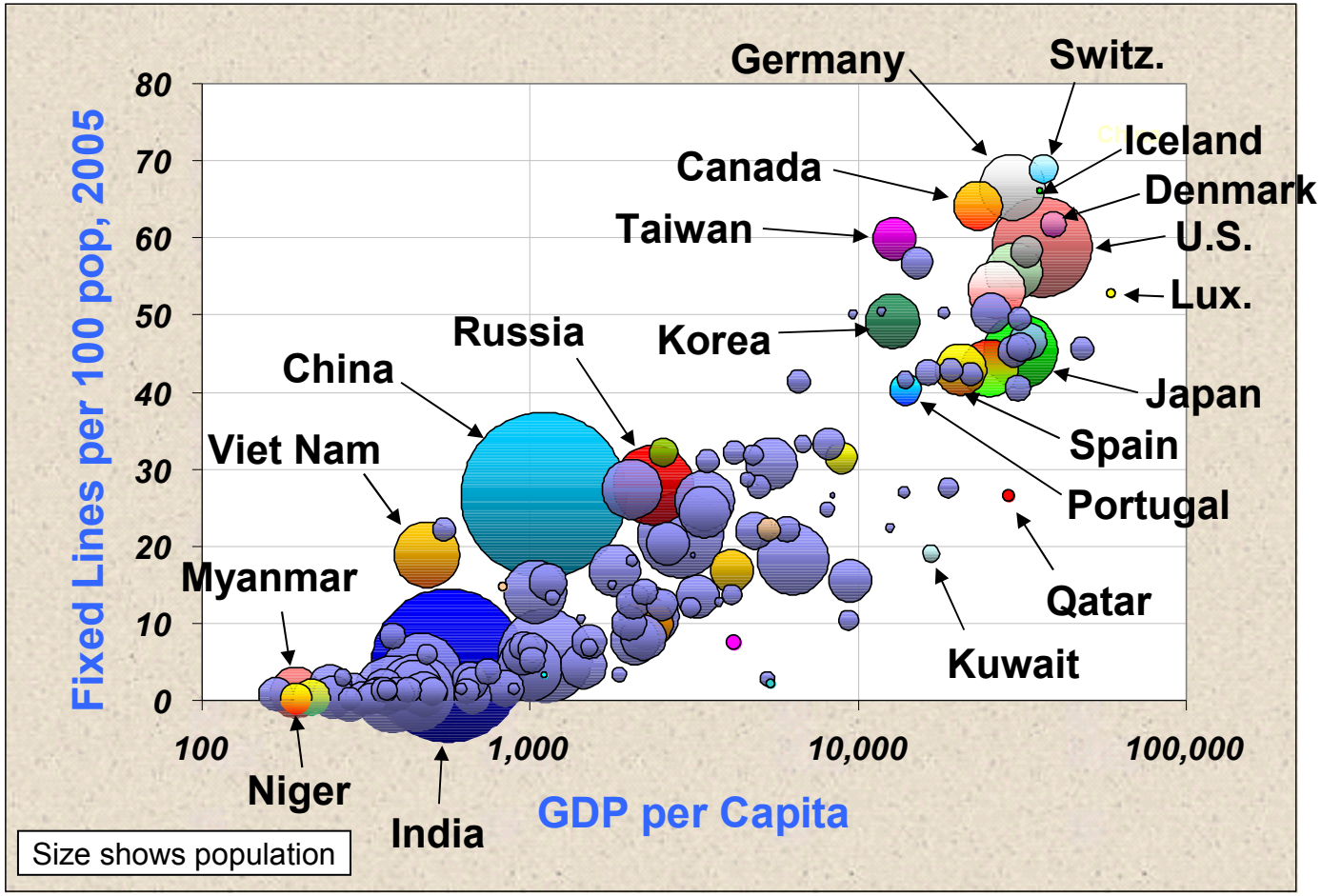
Global Customer Trends

Background – Fixed Lines

- Fixed Telephone Lines per 100 population

Background

Fixed Telephone lines per 100 pop. in 2005



Data source: ITU World Telecommunication Indicators 2006

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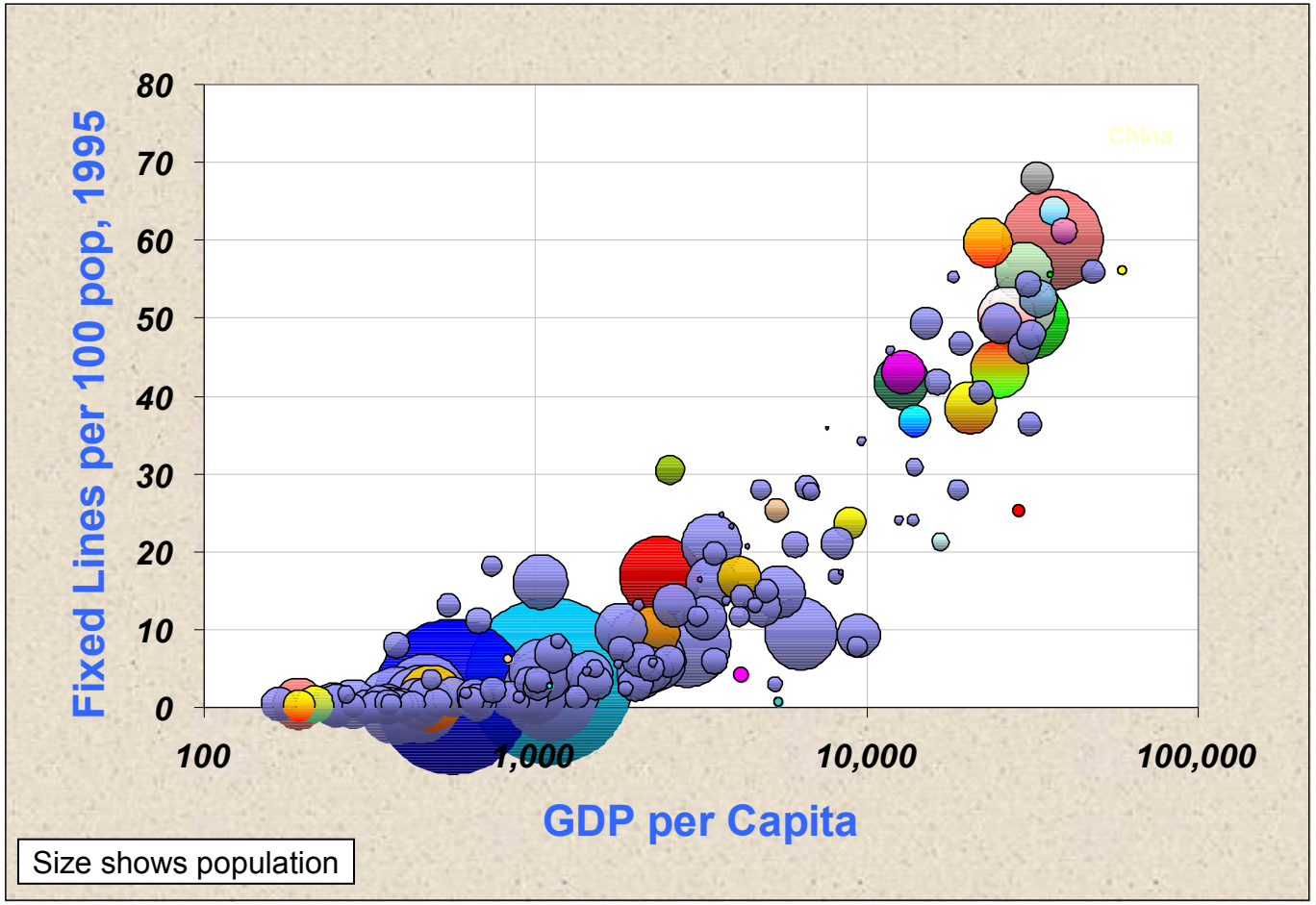

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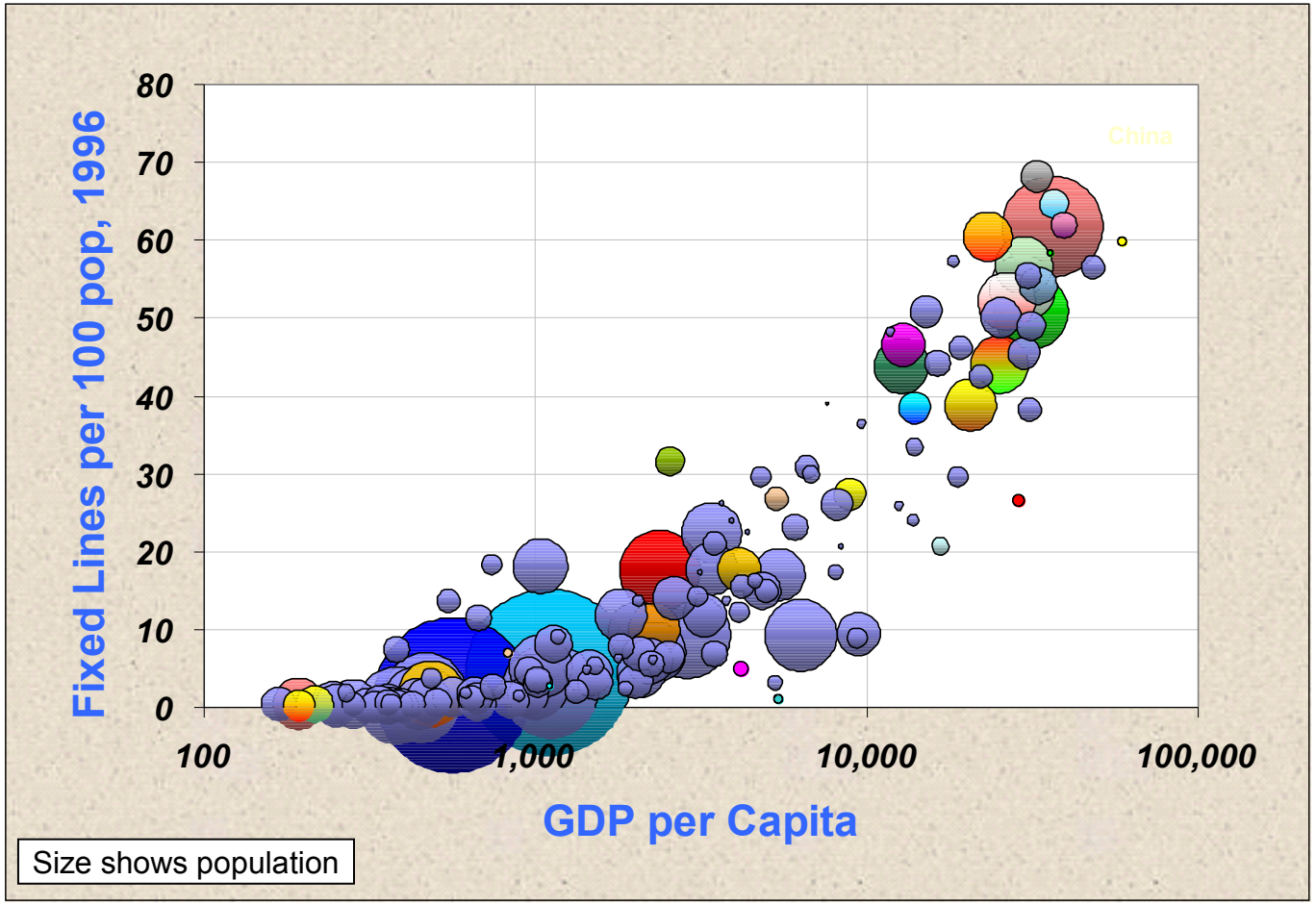

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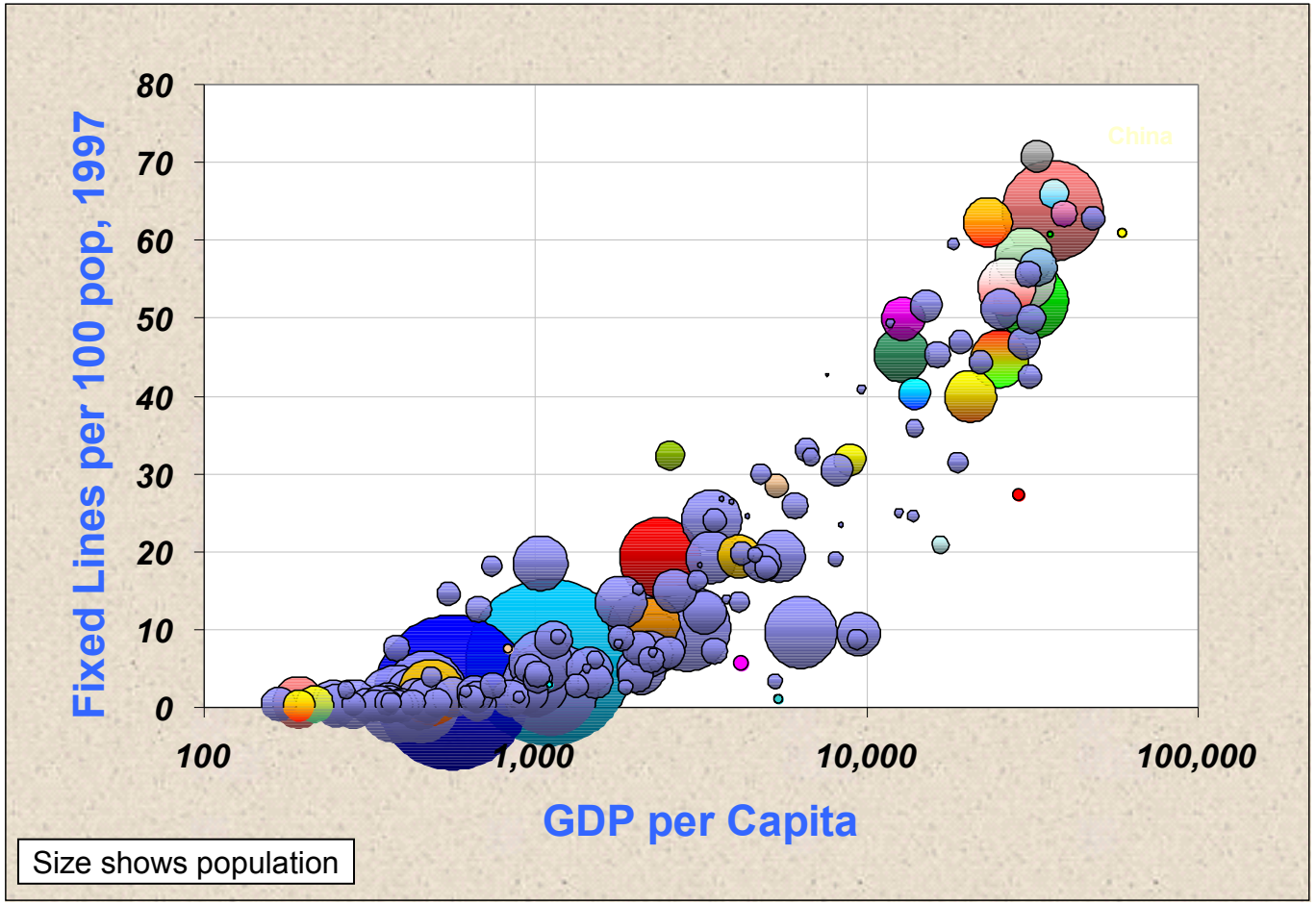

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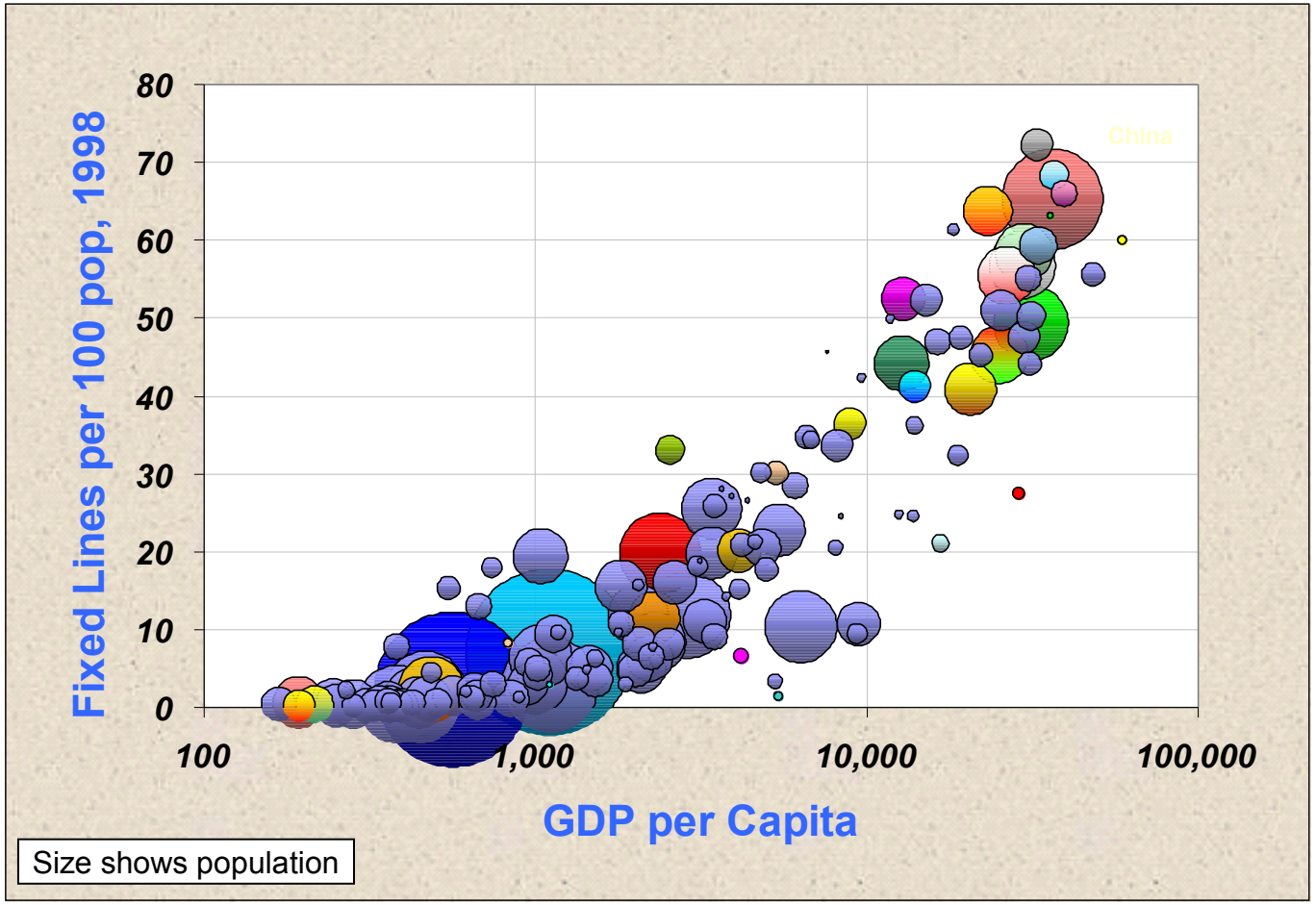

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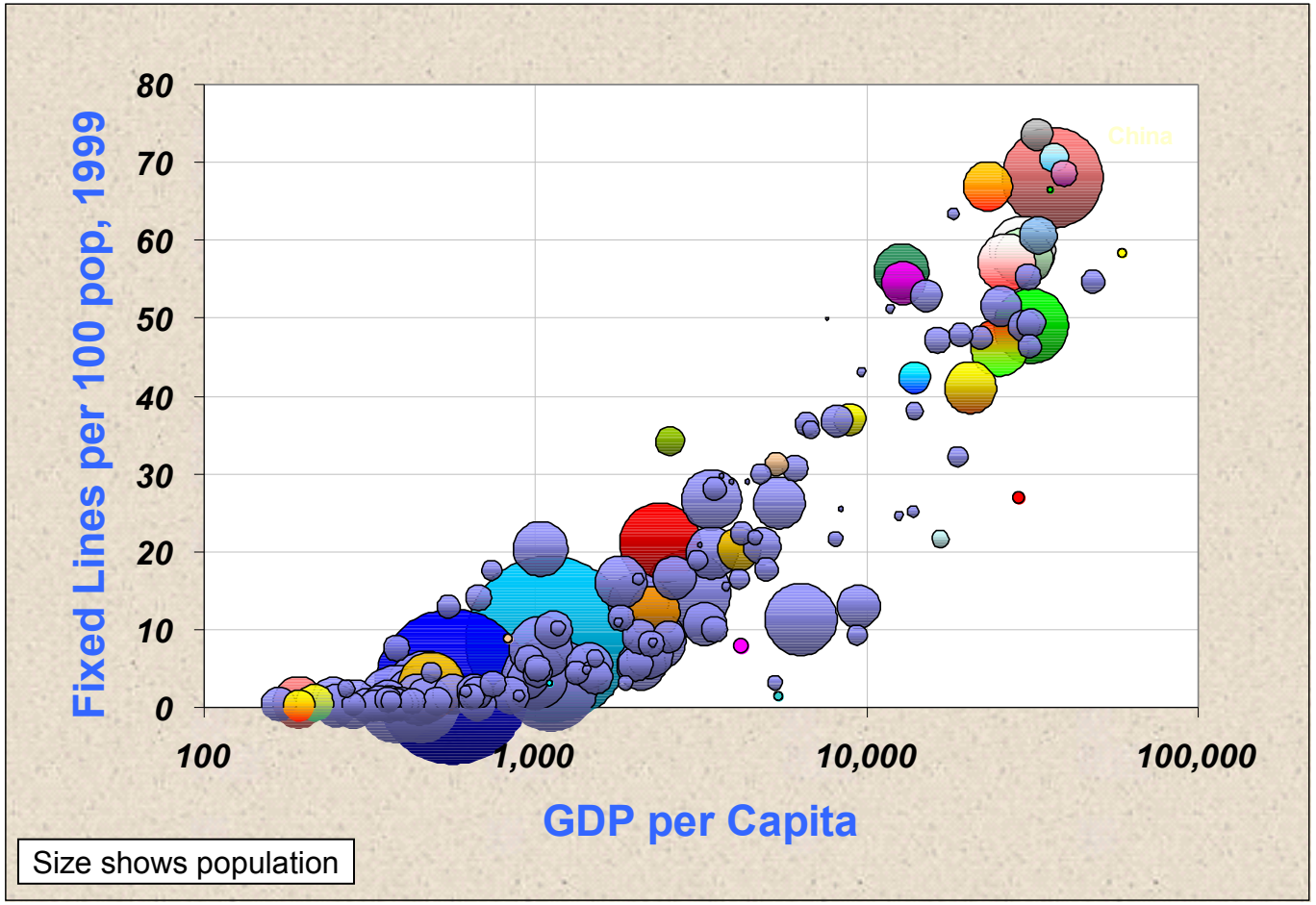

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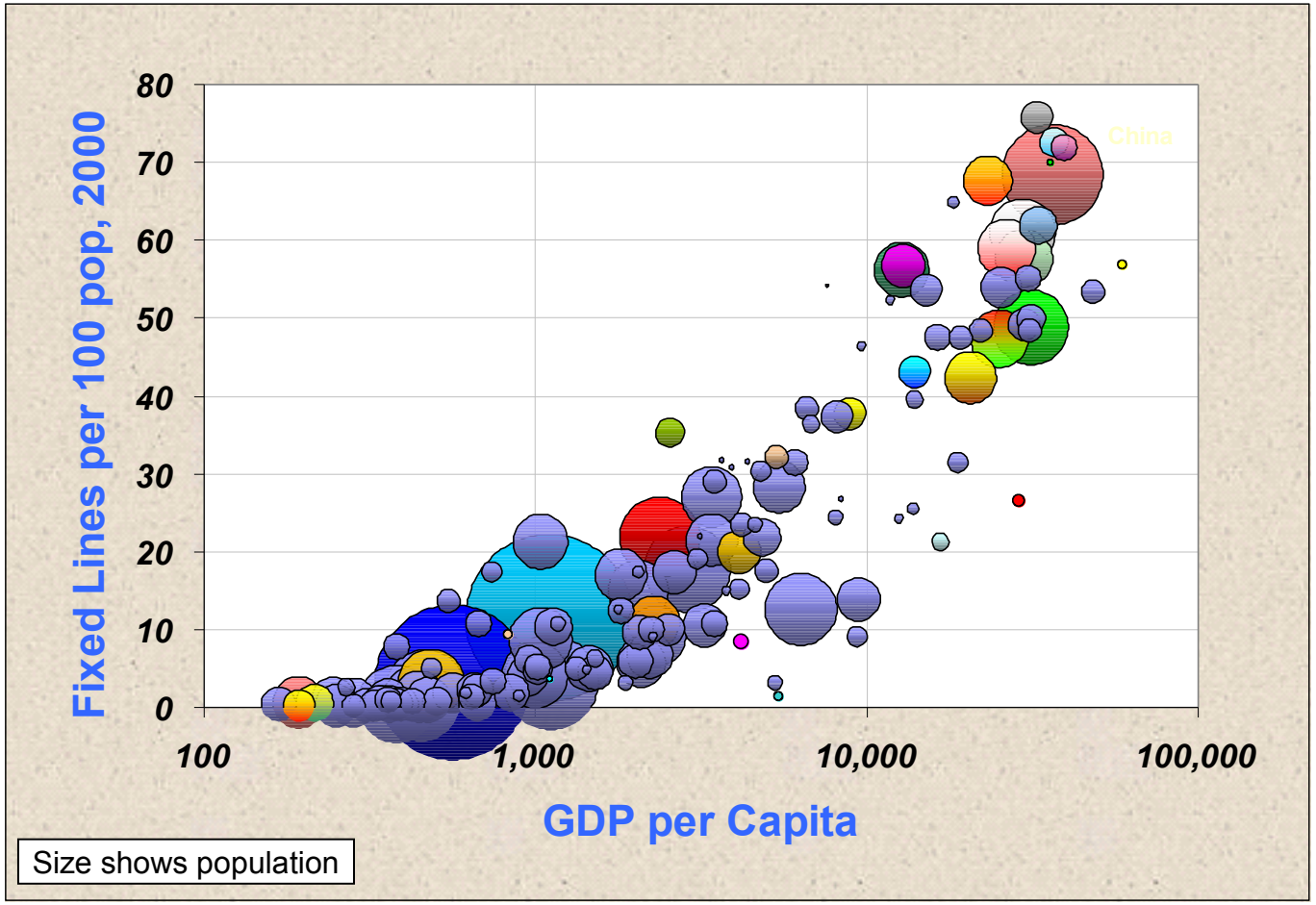

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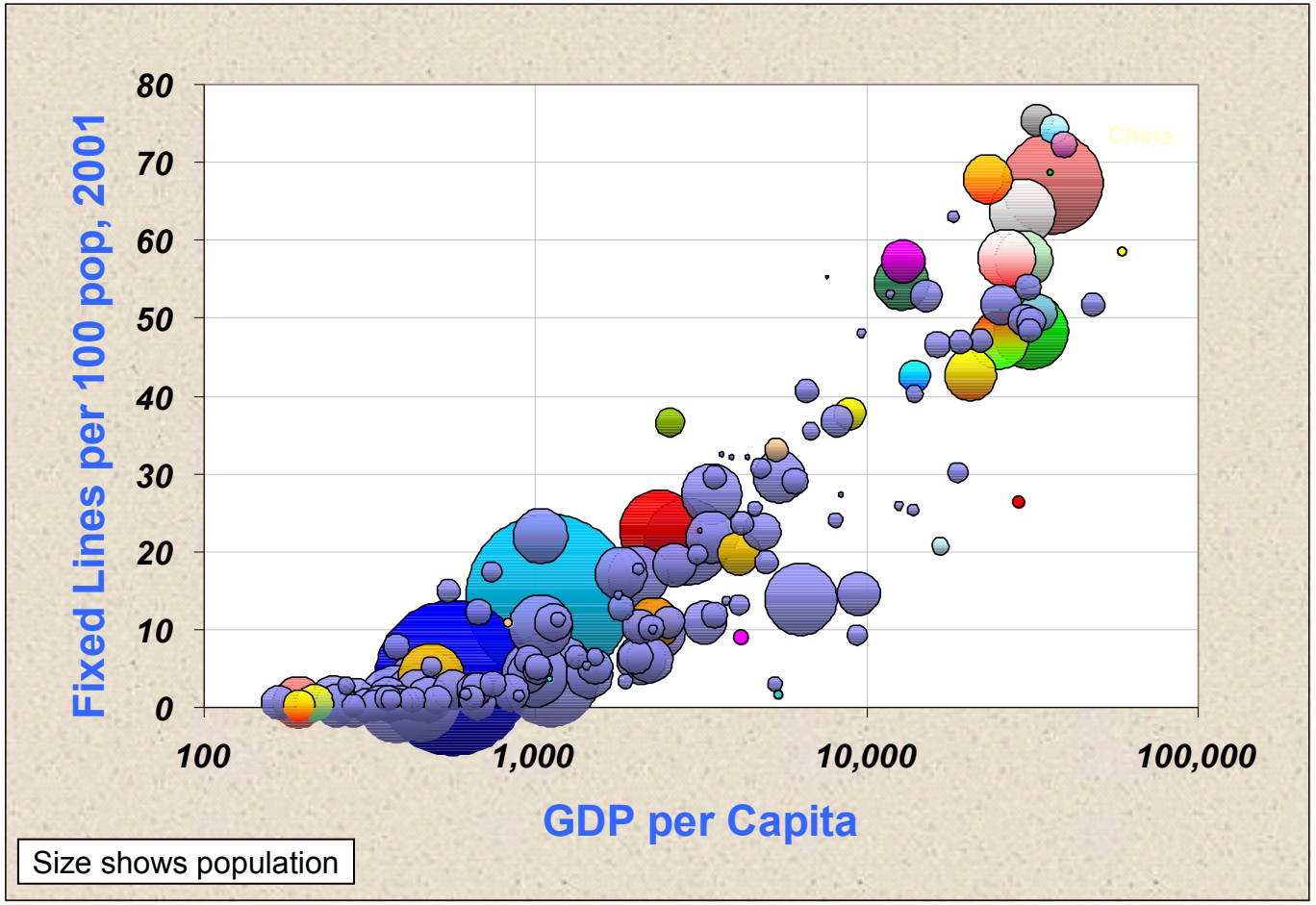

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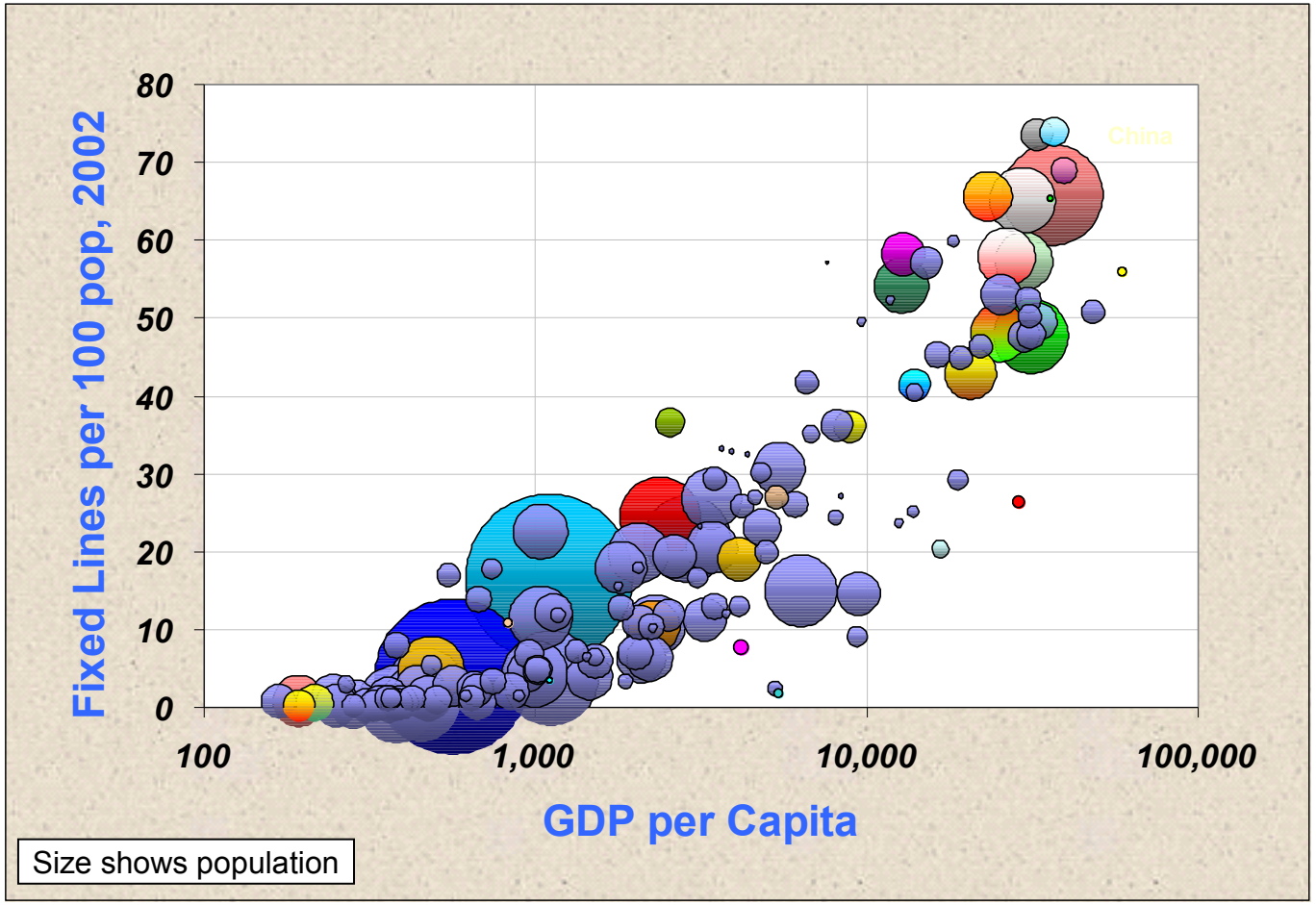

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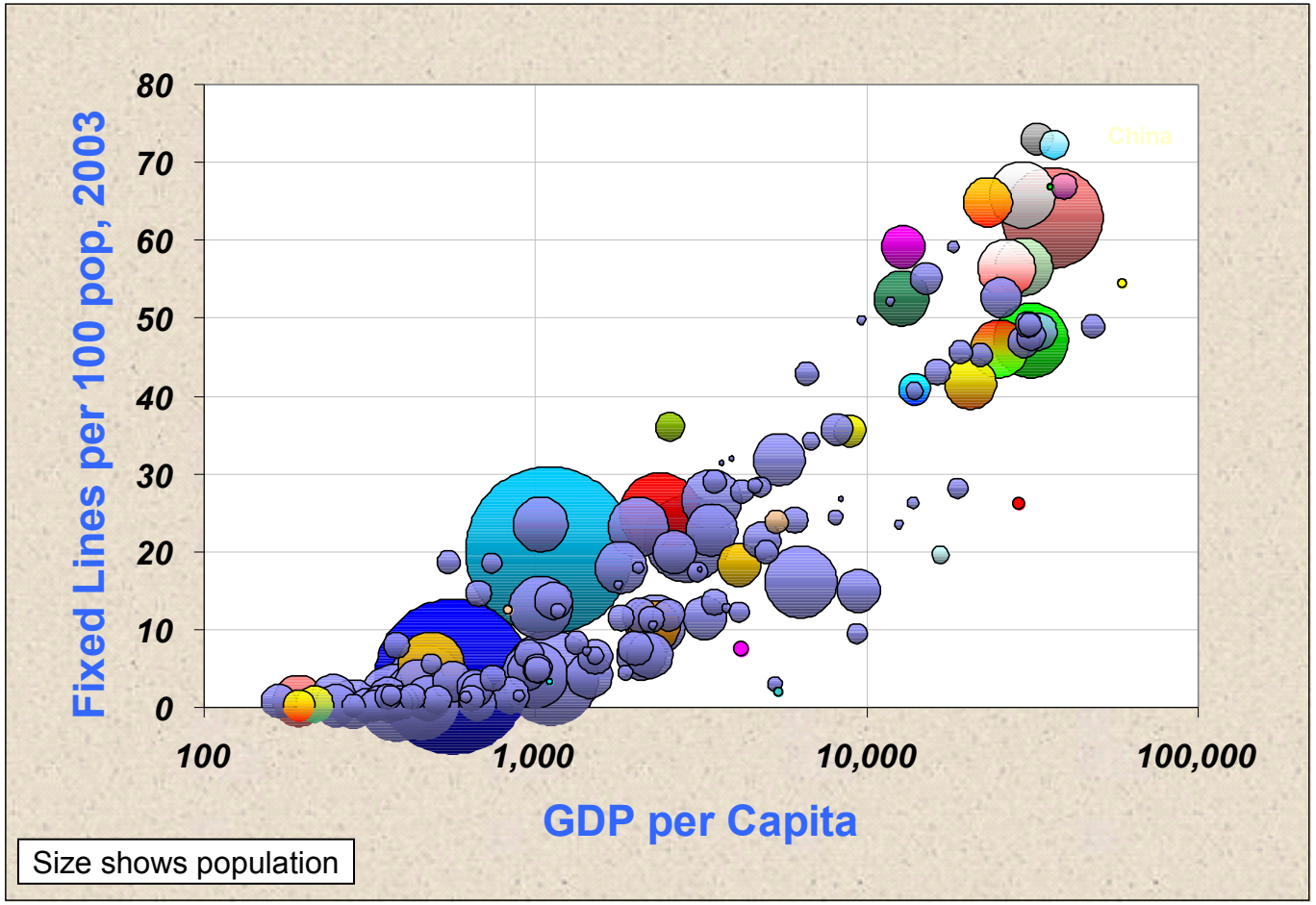

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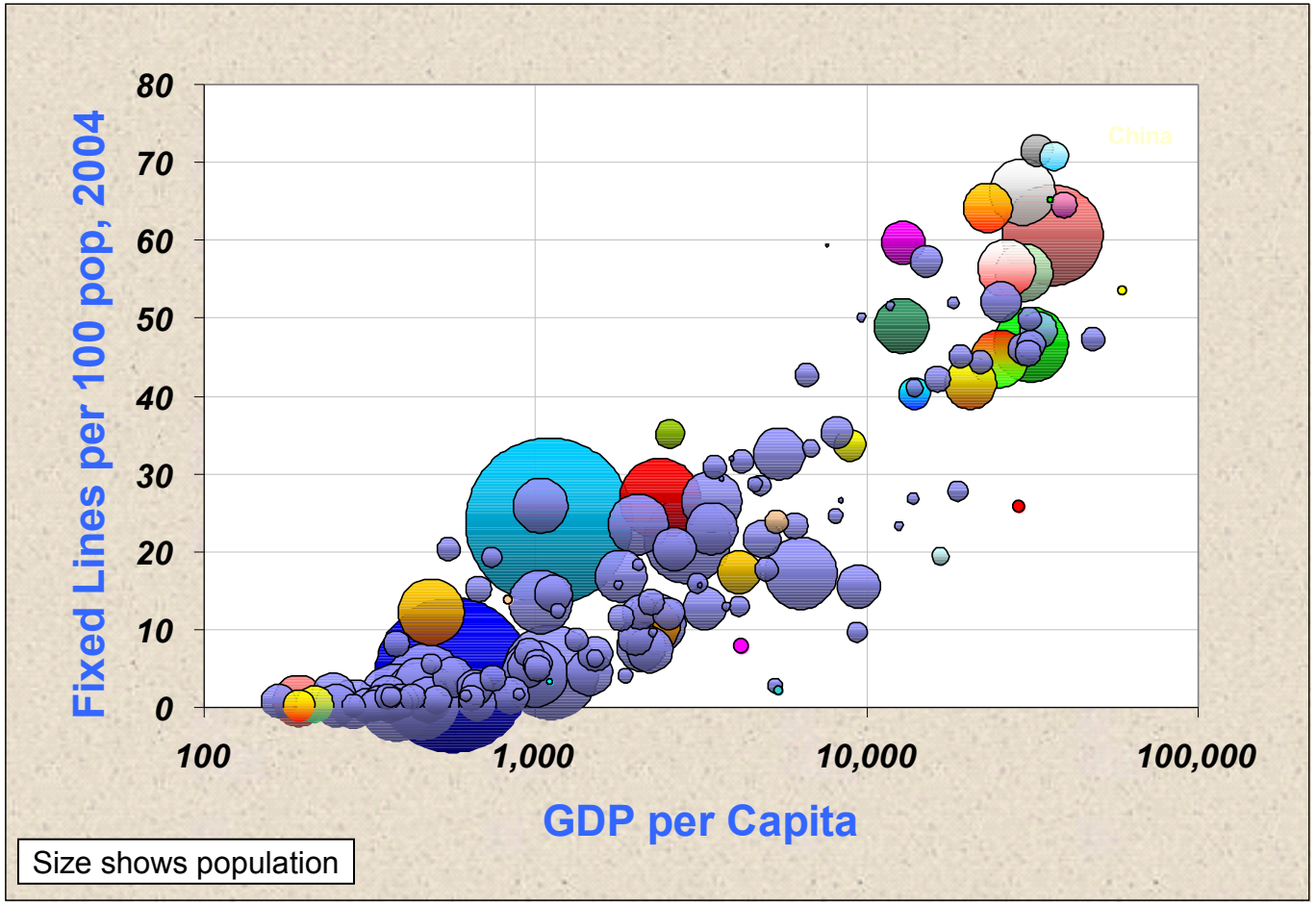

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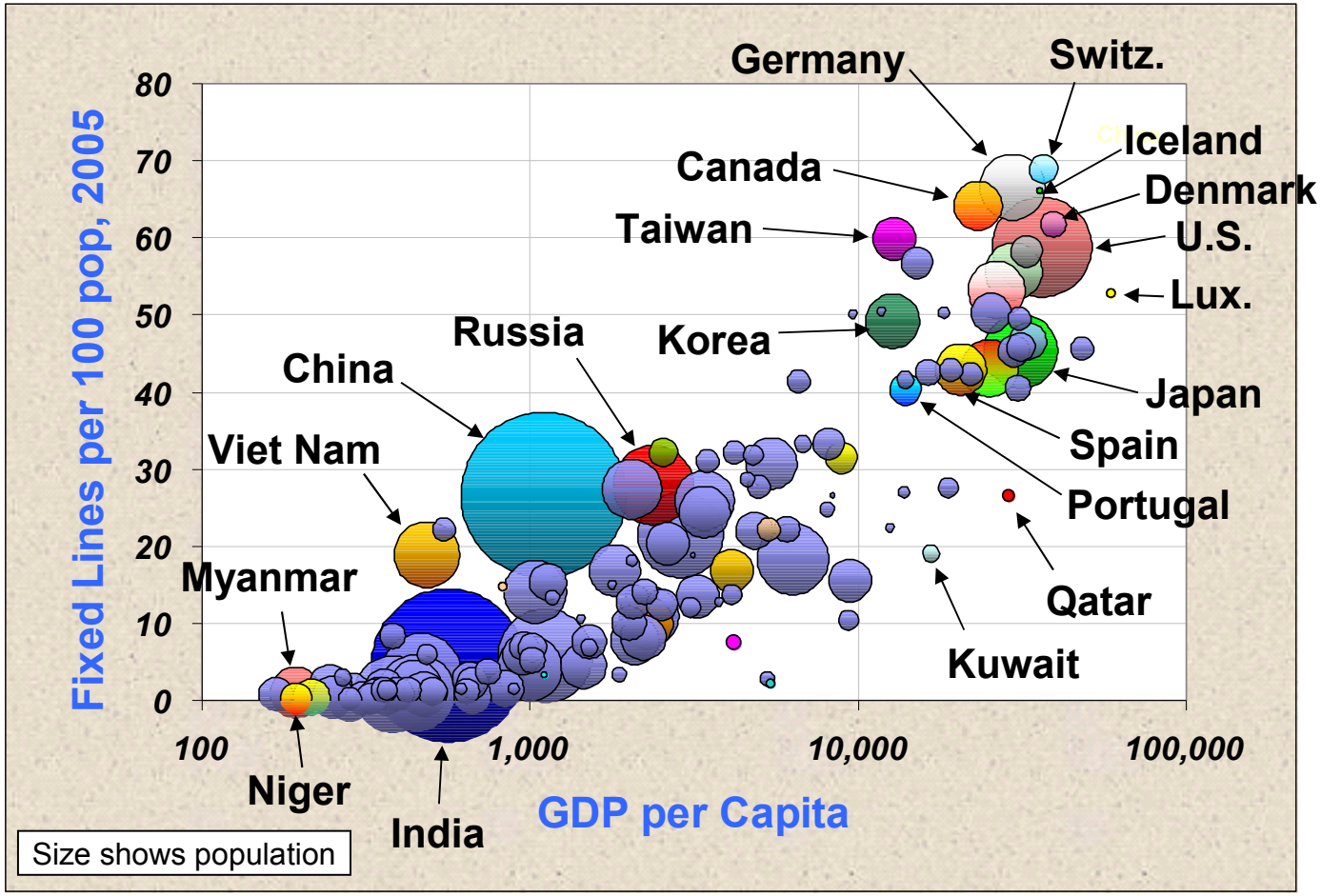

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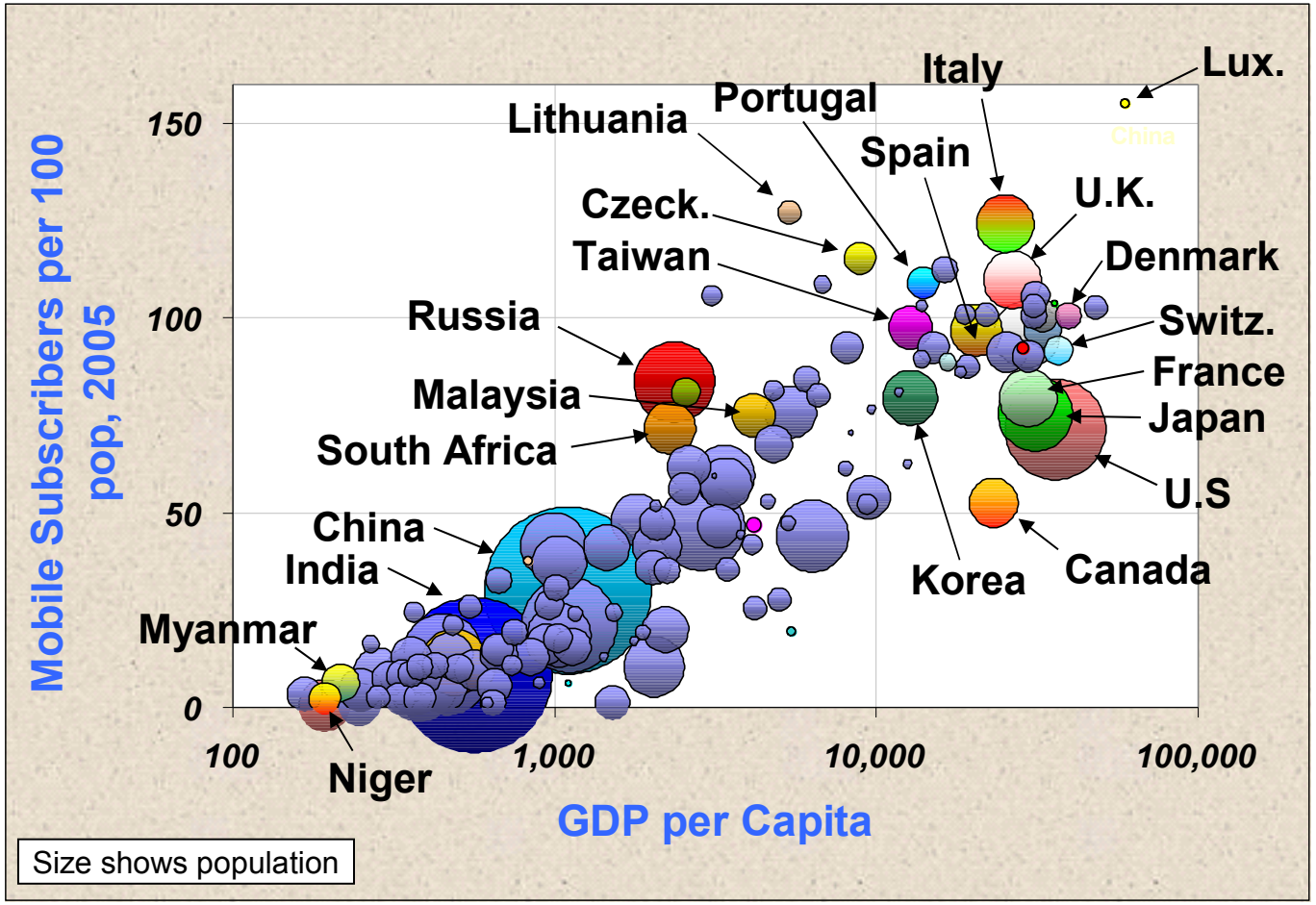
Background – Mobile Subscribers

- Mobile Subscribers per 100 population

Background

Mobile Subscribers per 100 pop. in 2005



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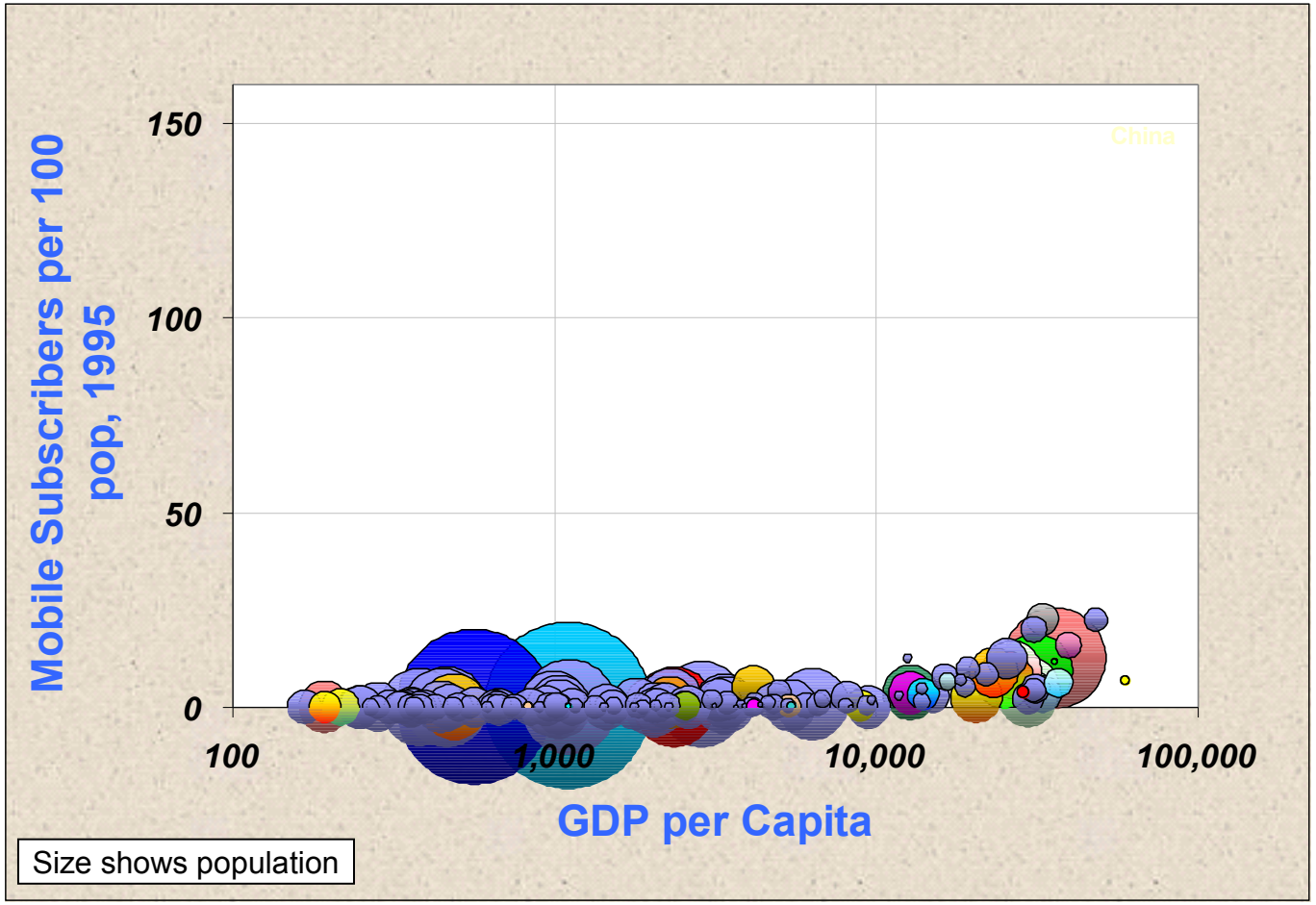

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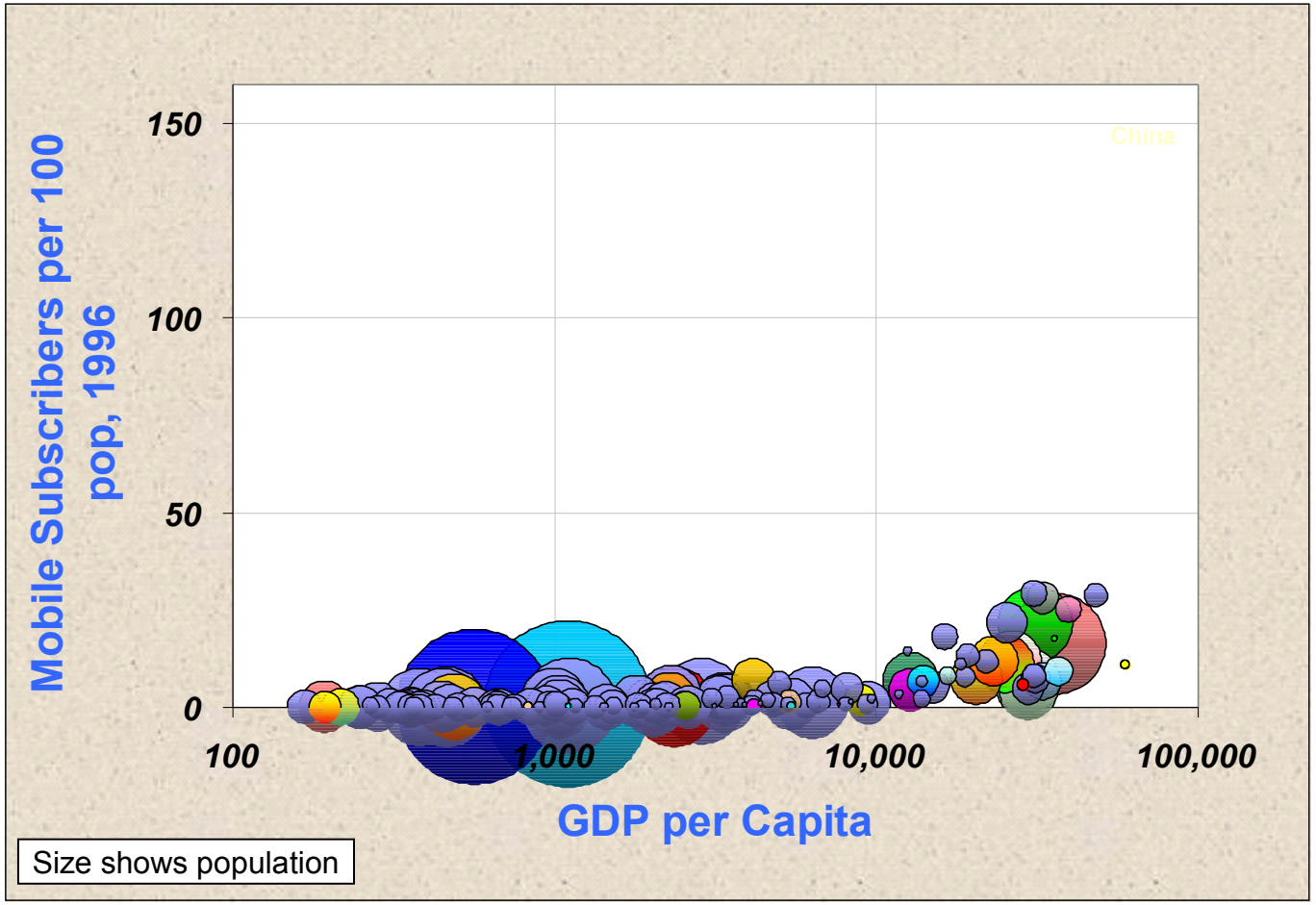

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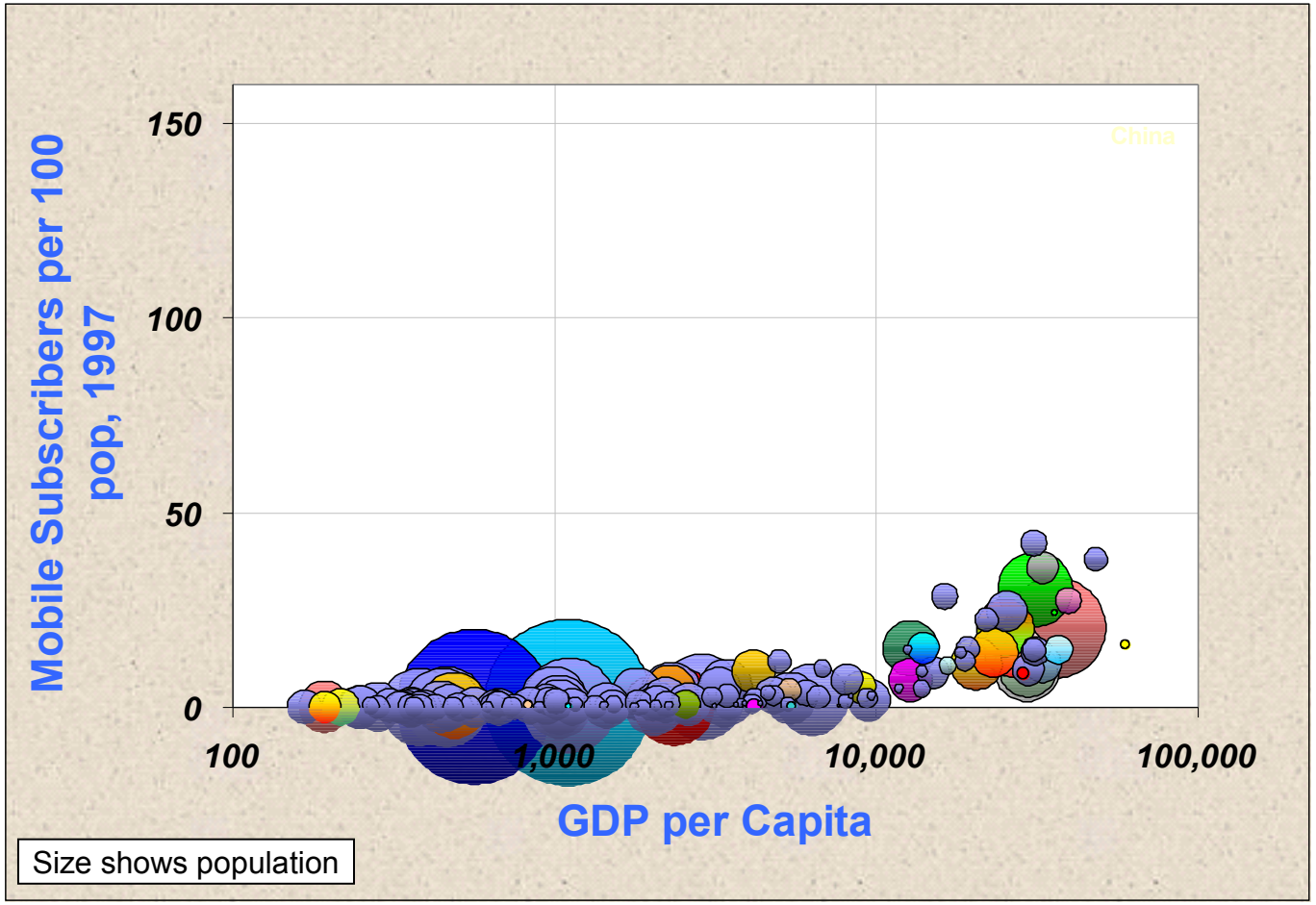

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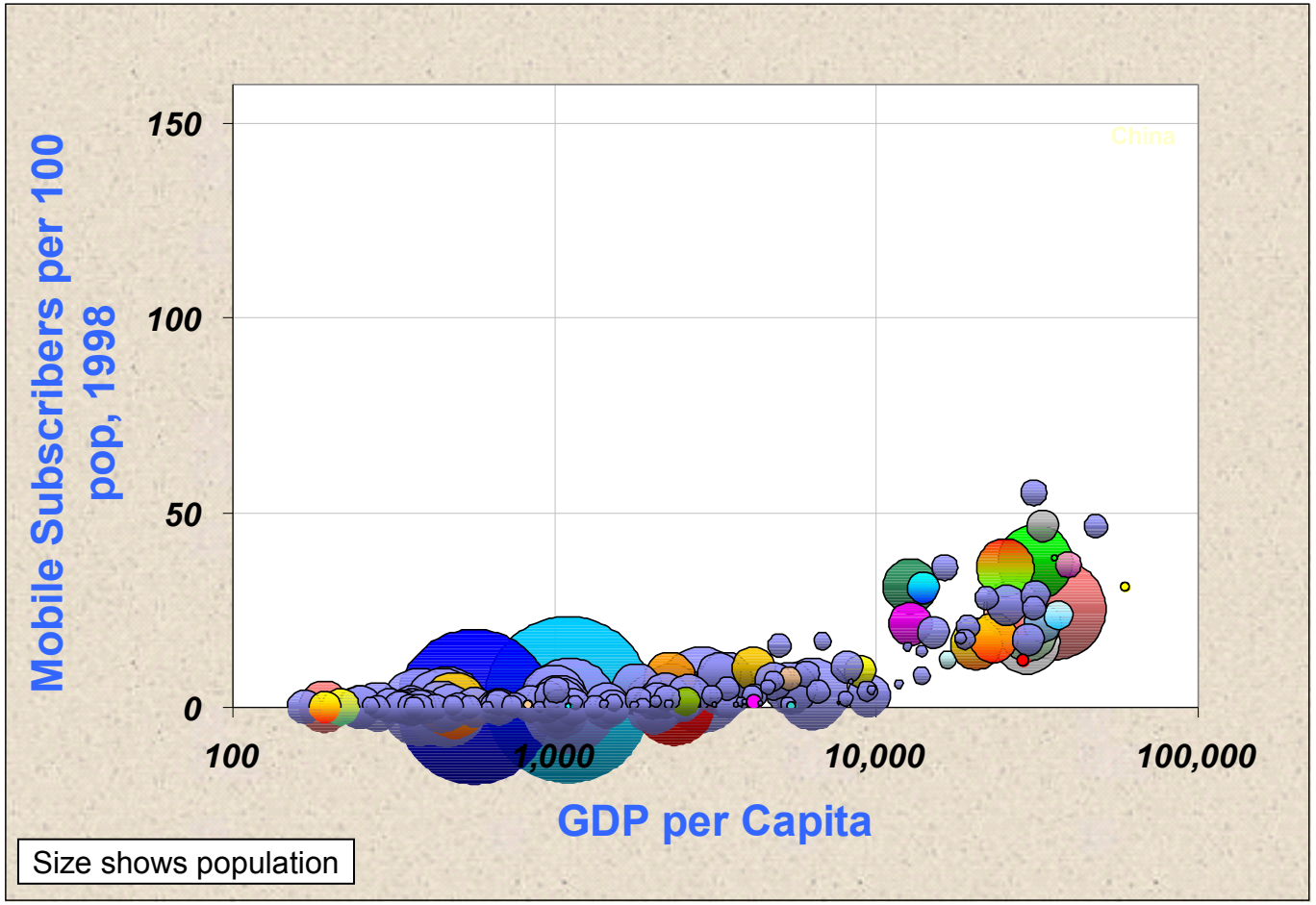

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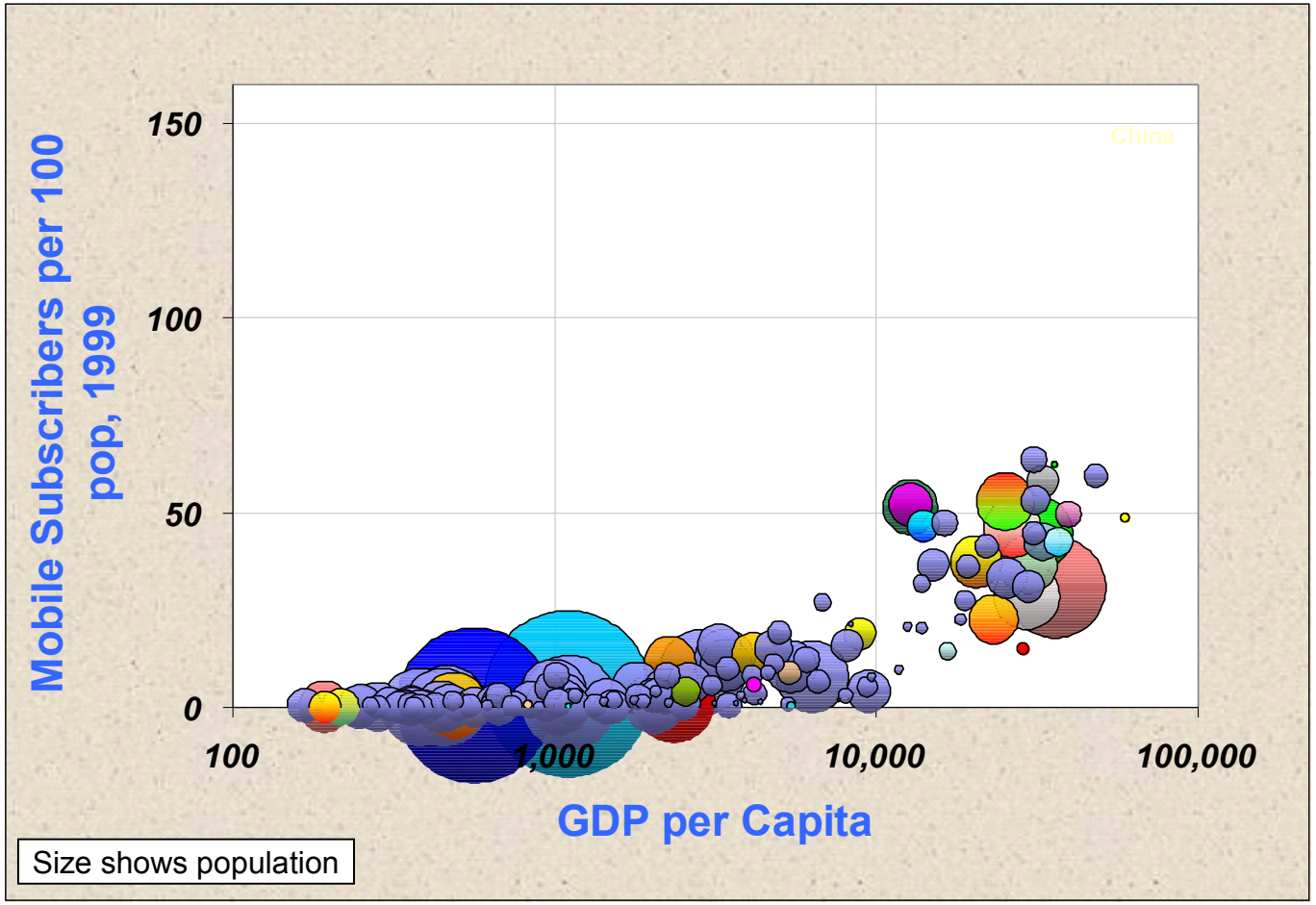

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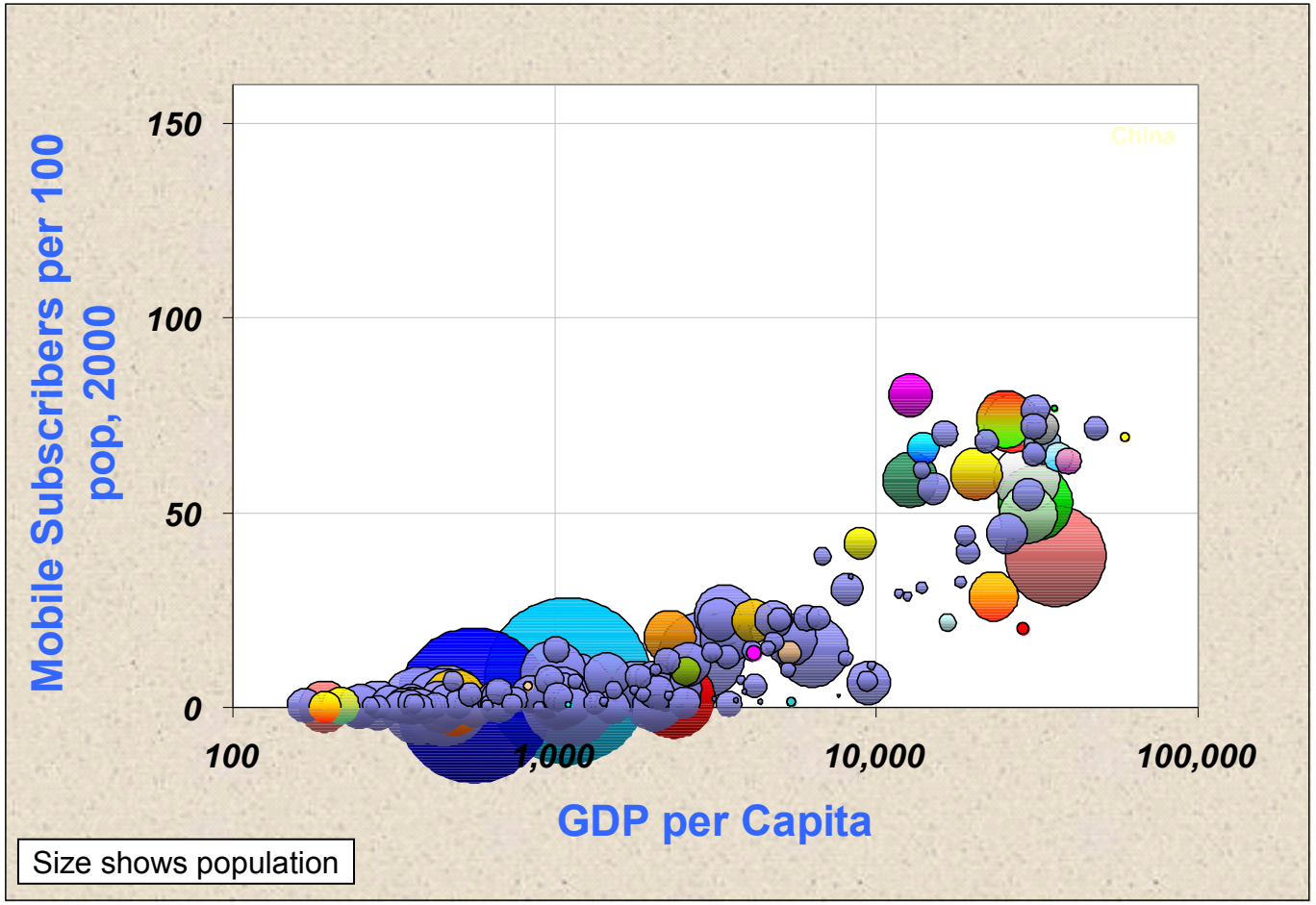

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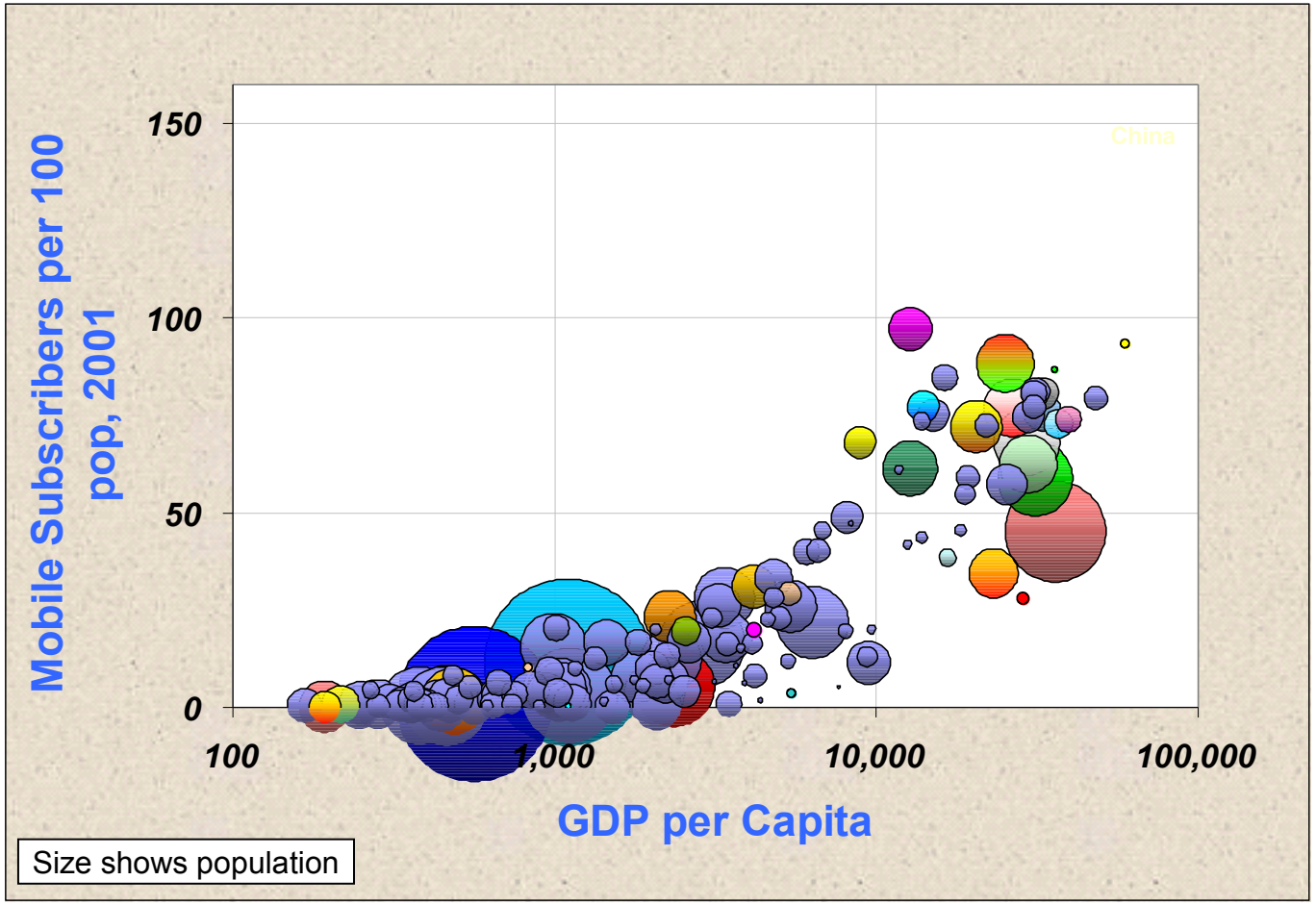

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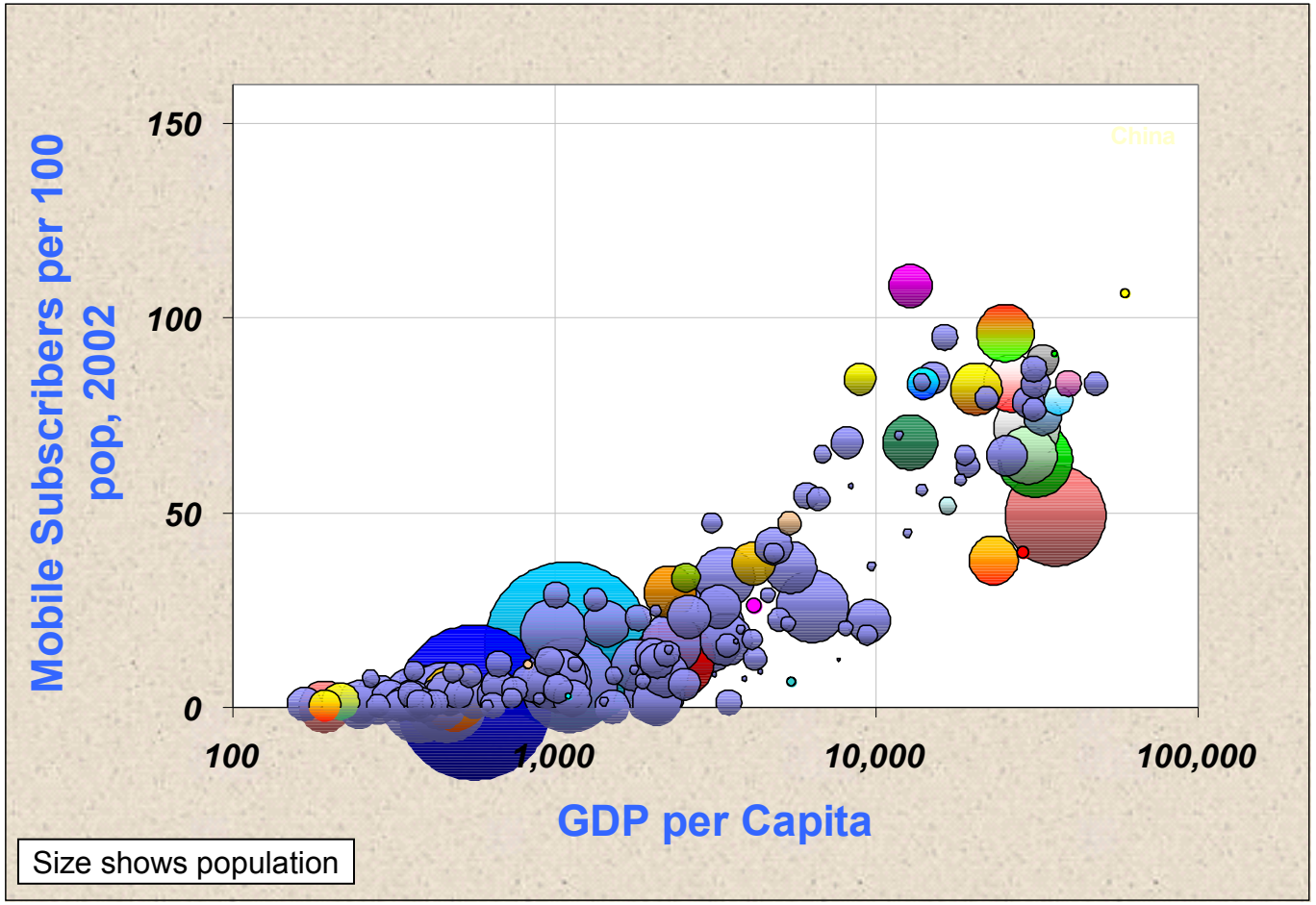

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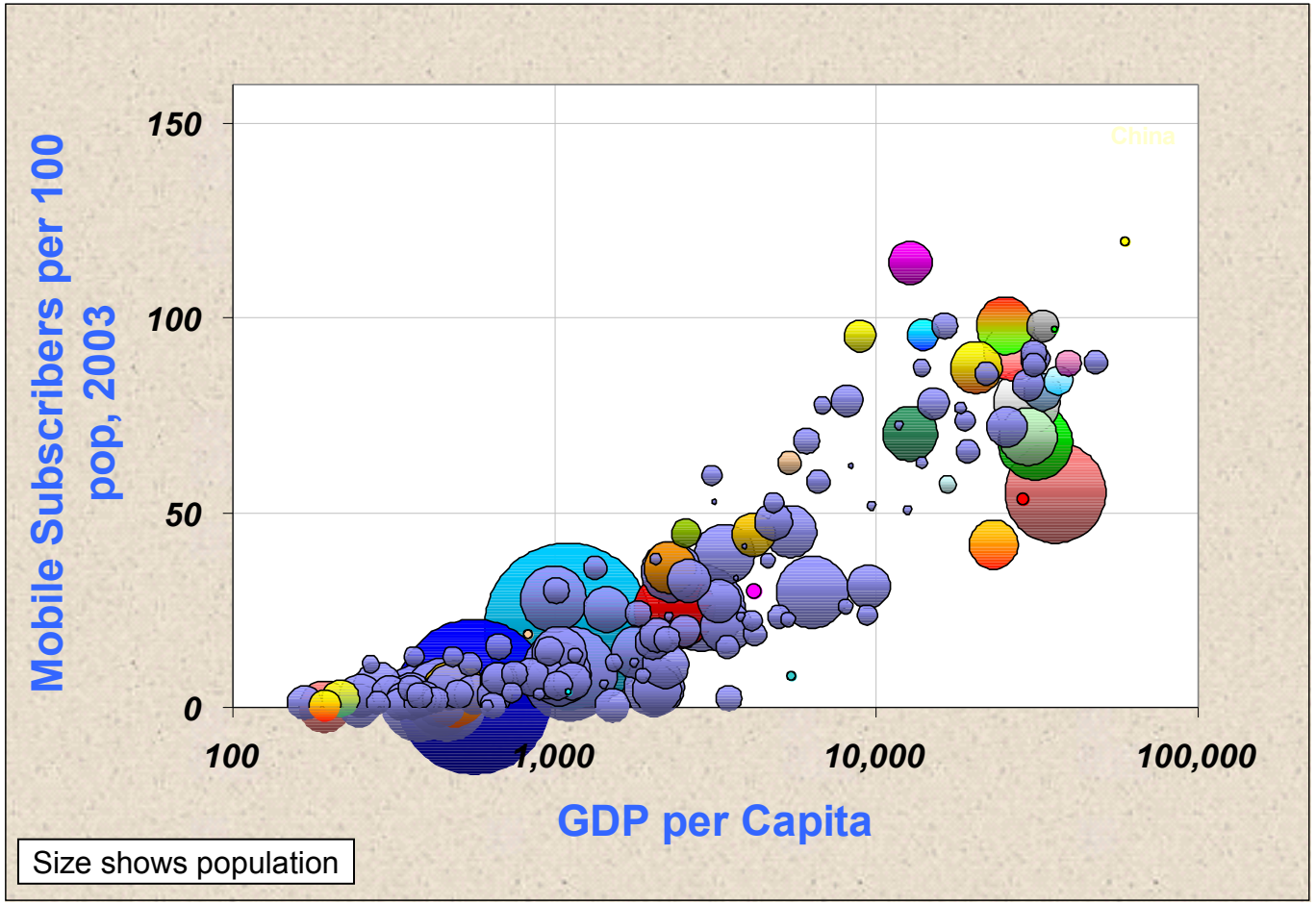

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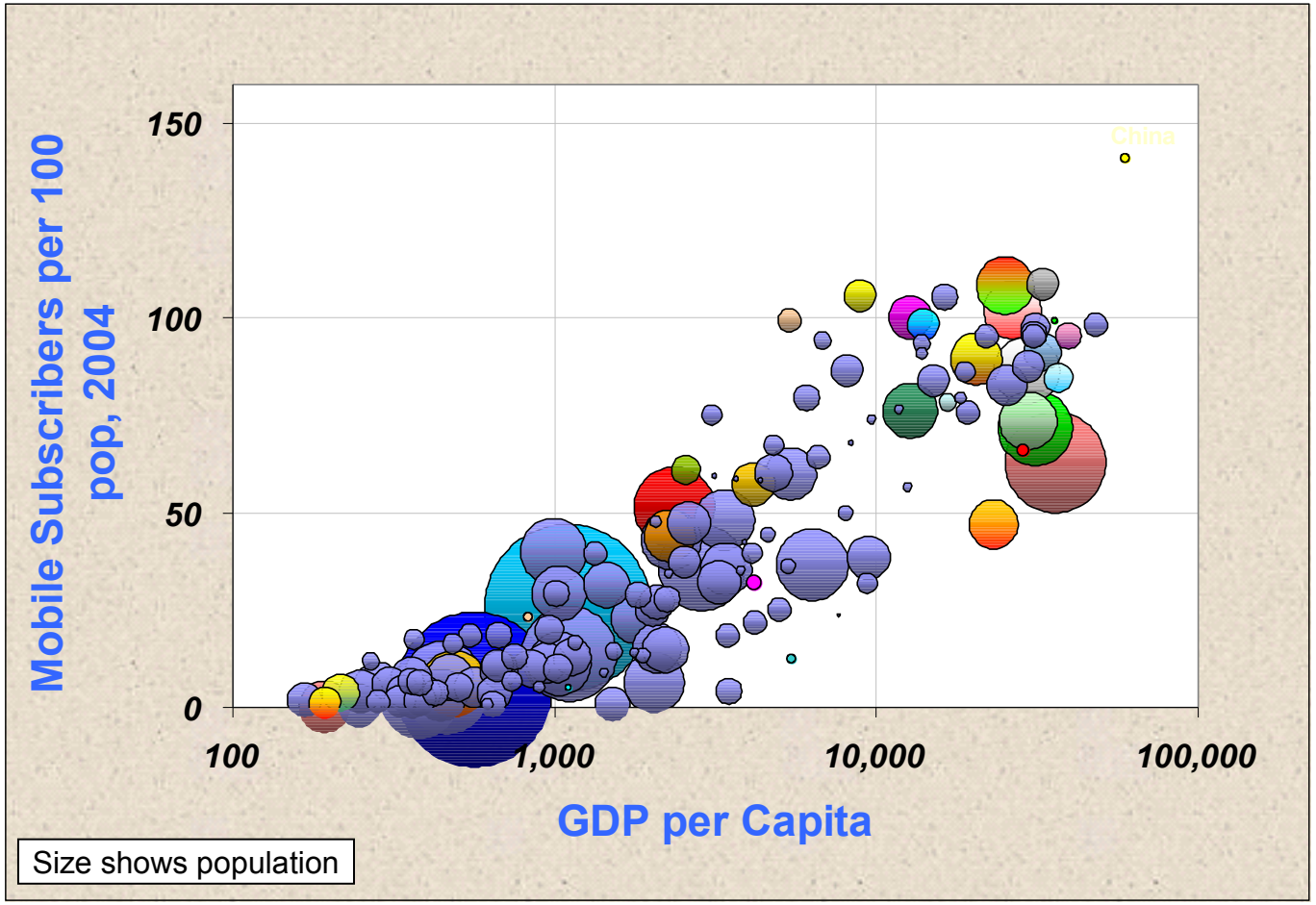

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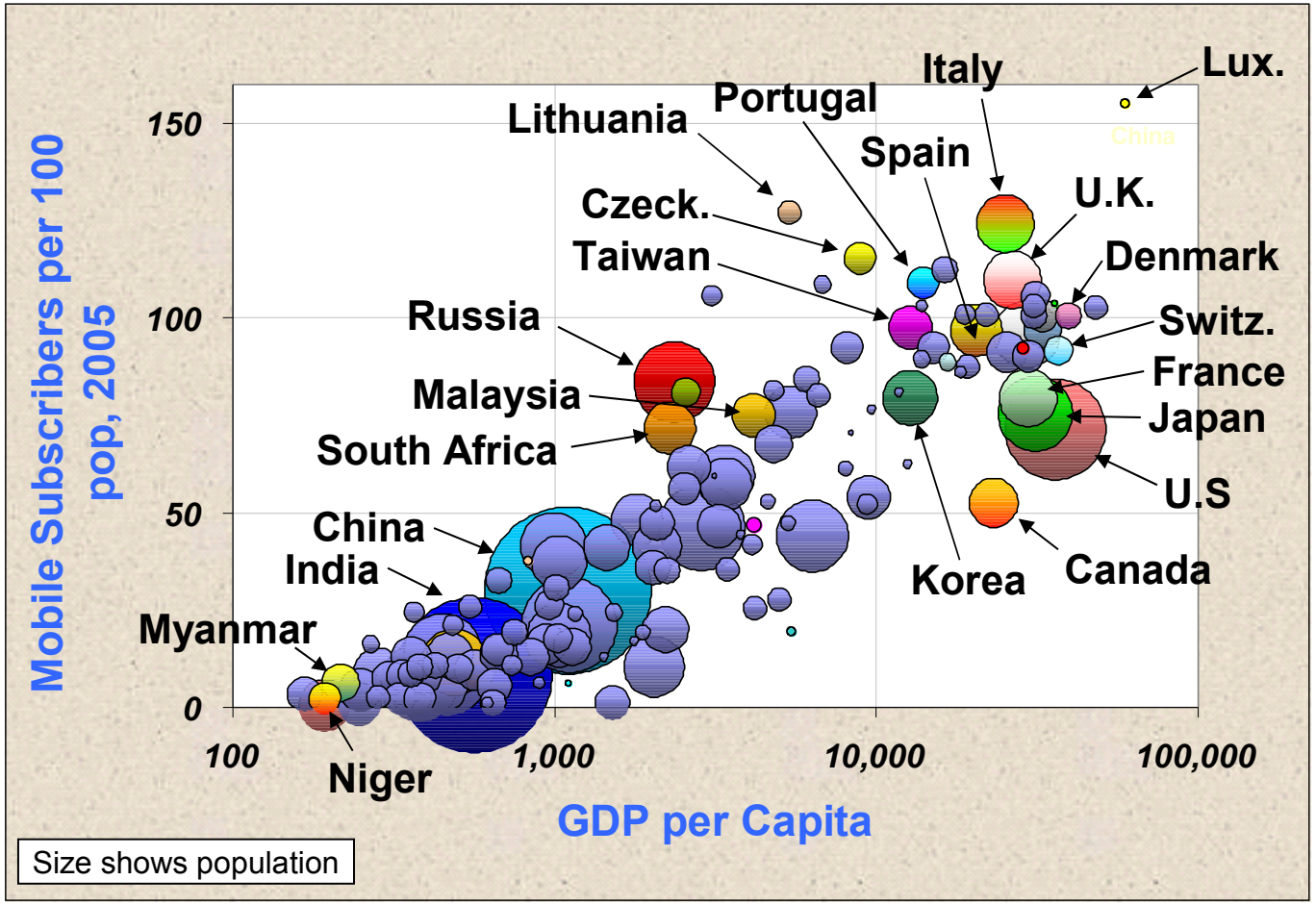

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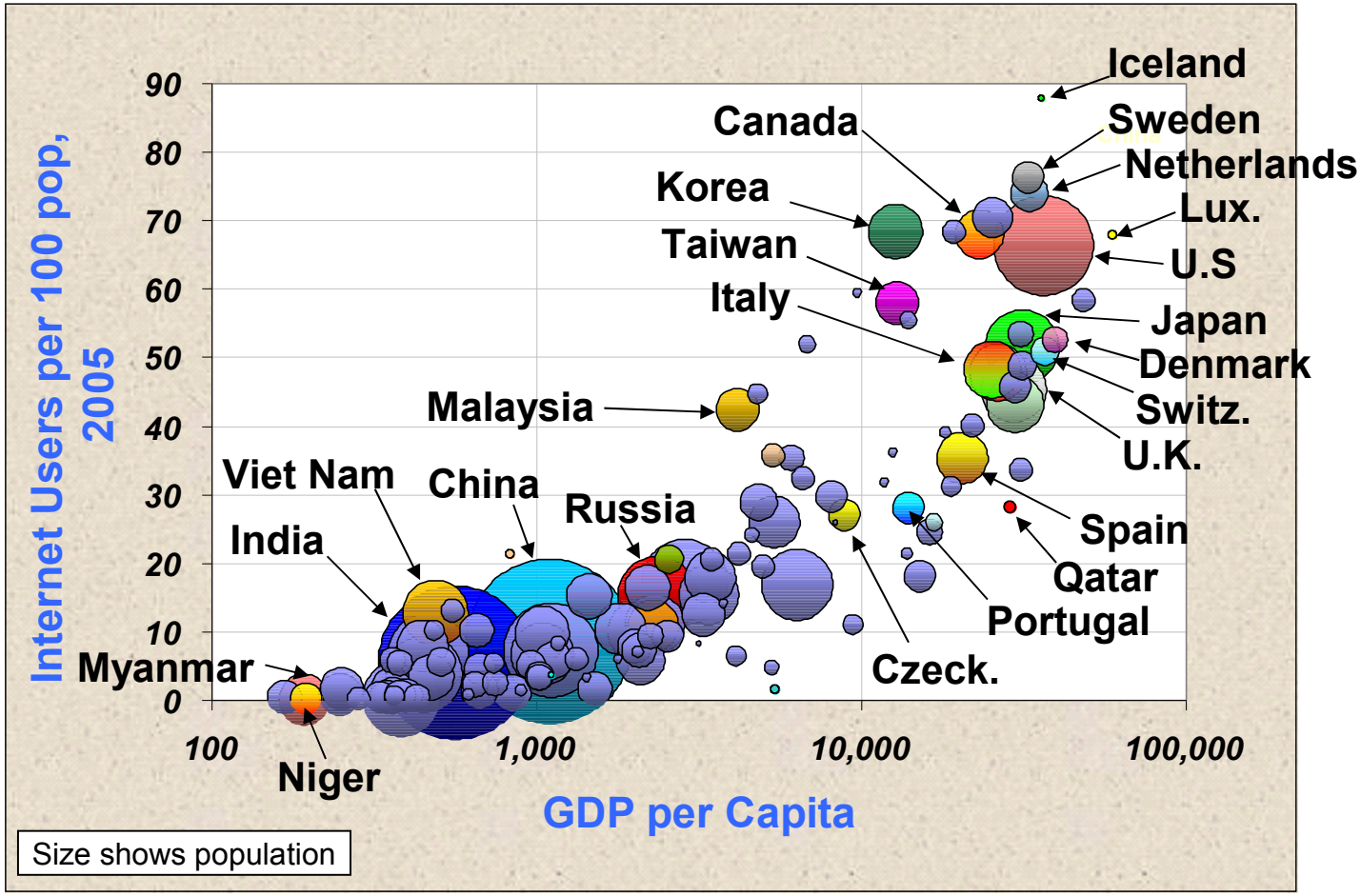
Background – Internet Users

- Internet Users per 100 population

Background

Internet Users per 100 pop. in 2005



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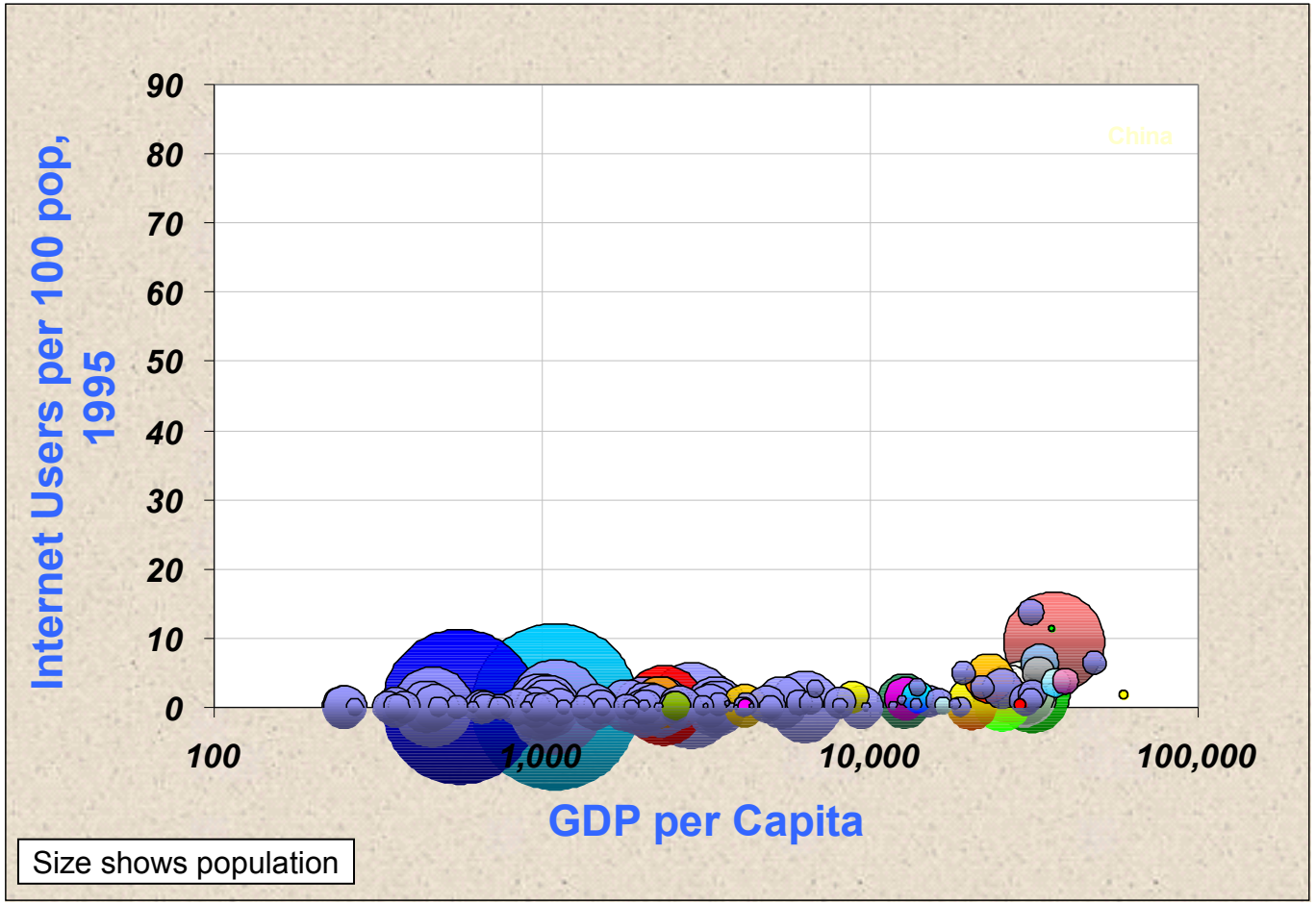

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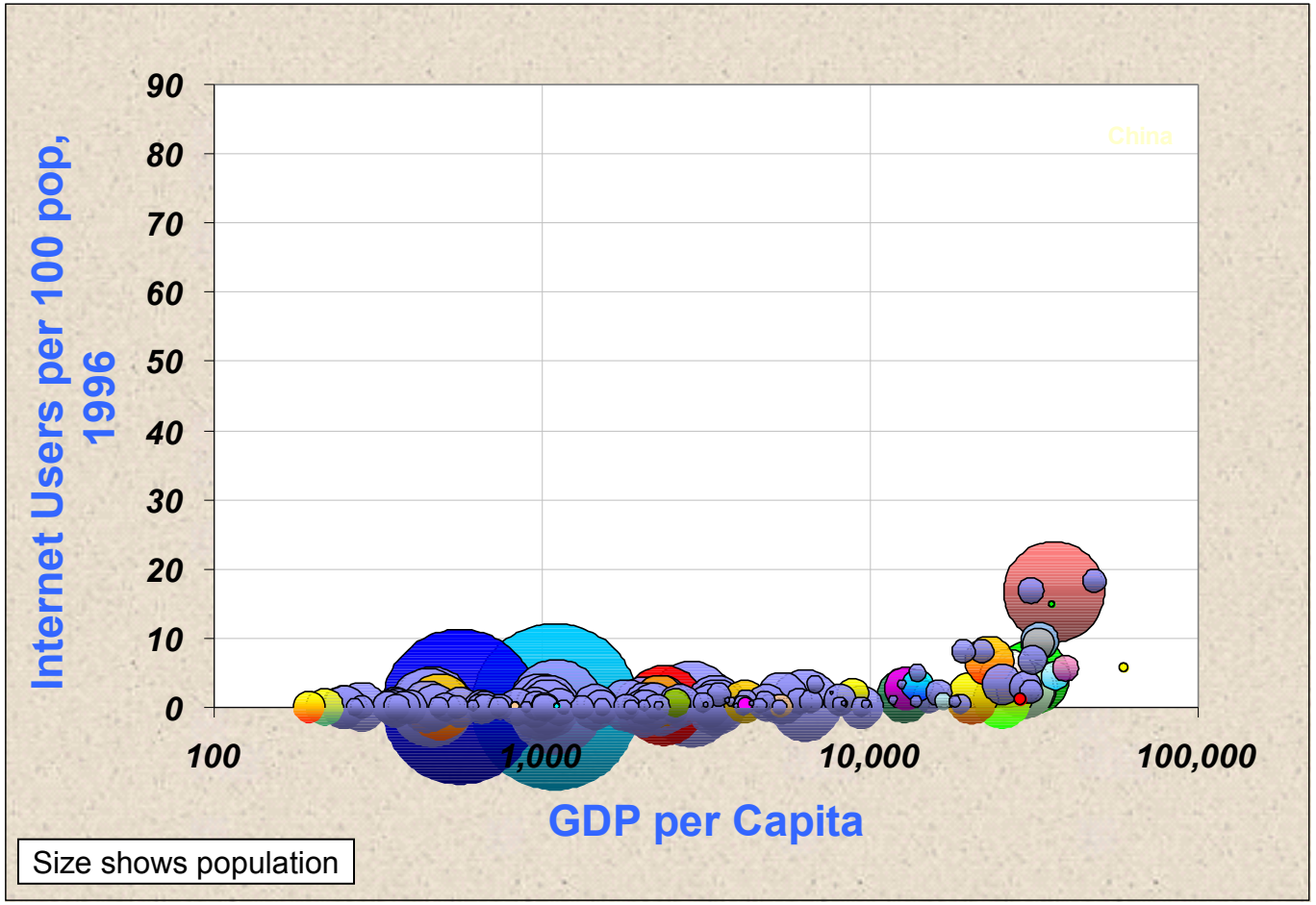

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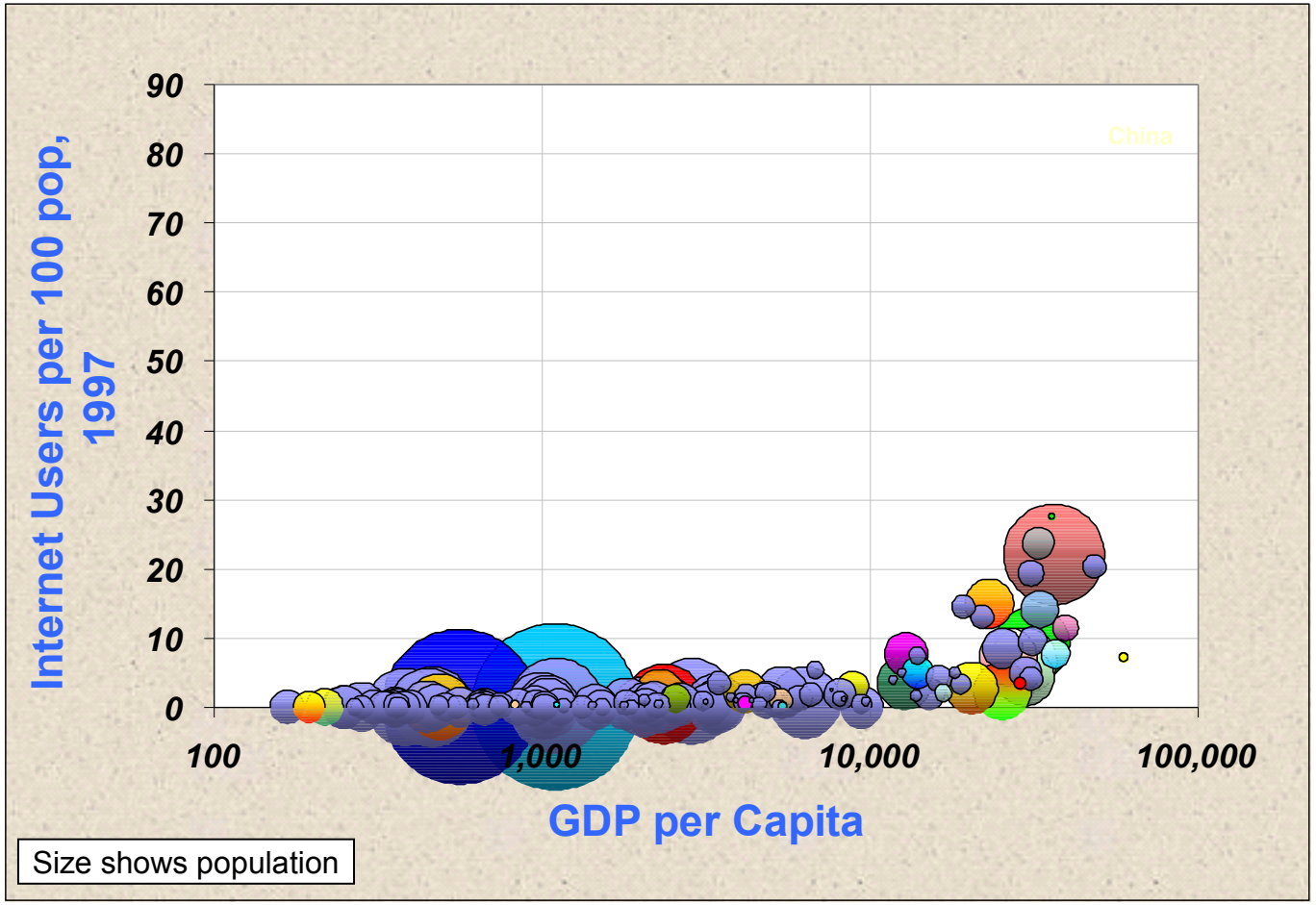

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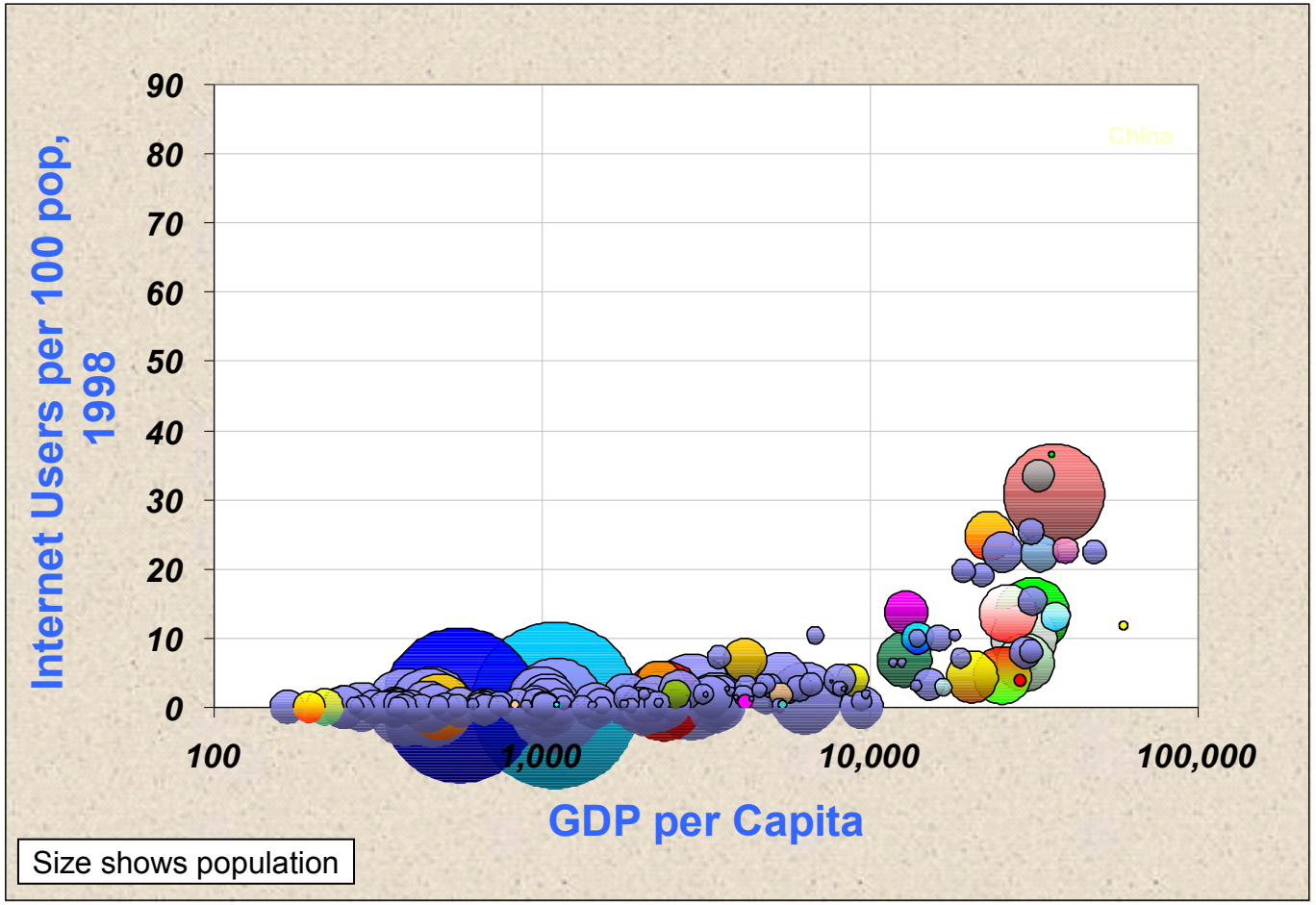

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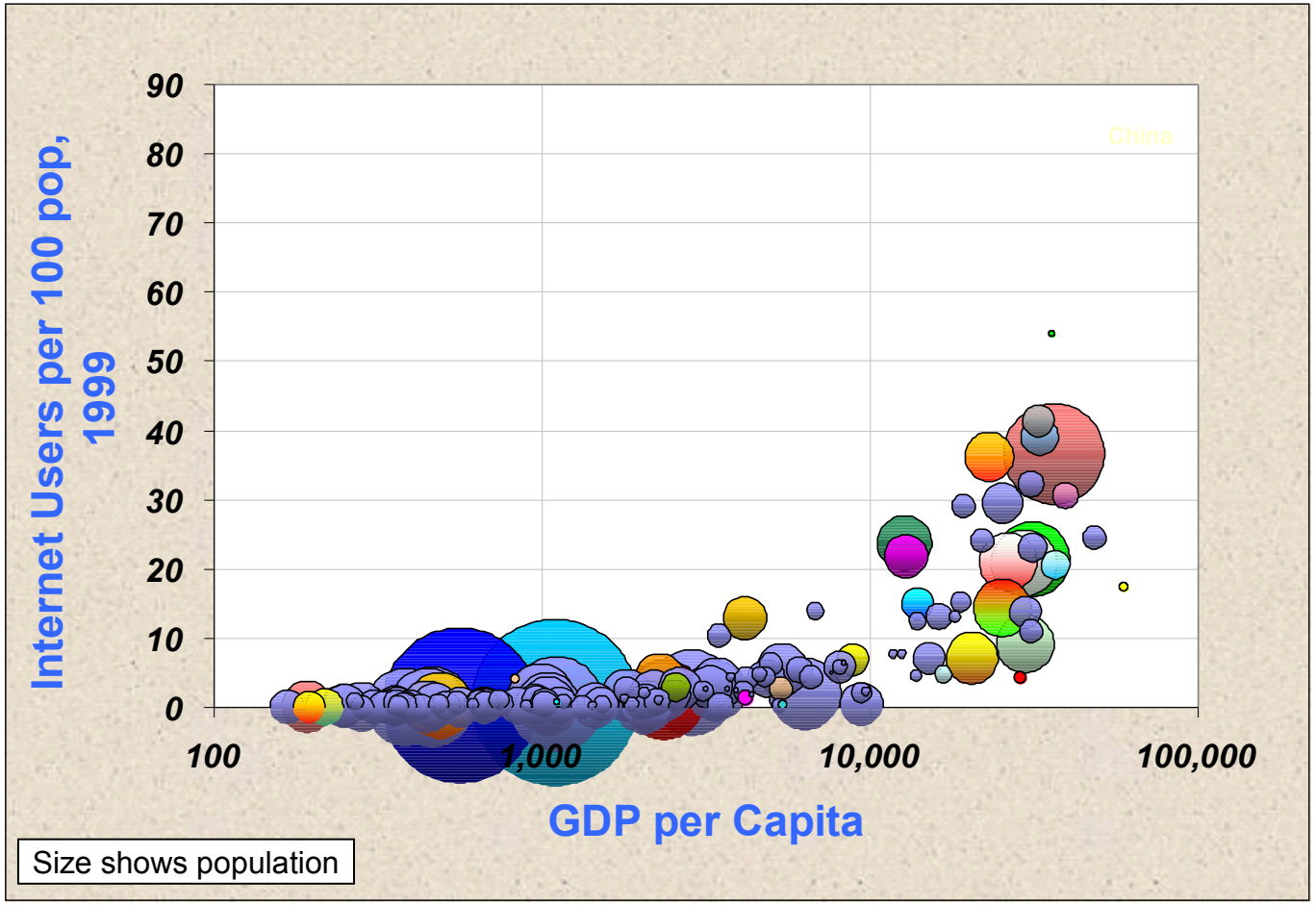

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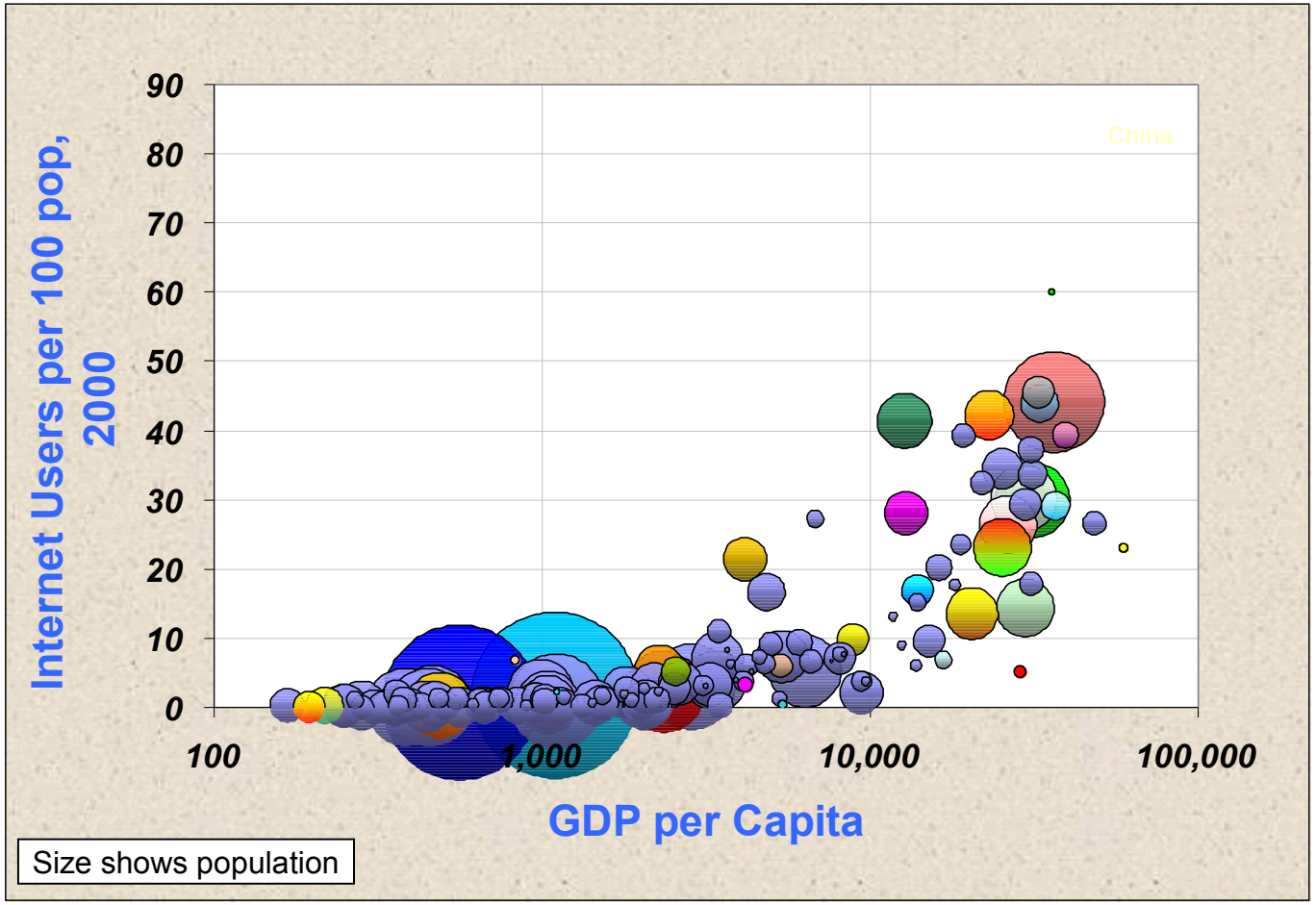

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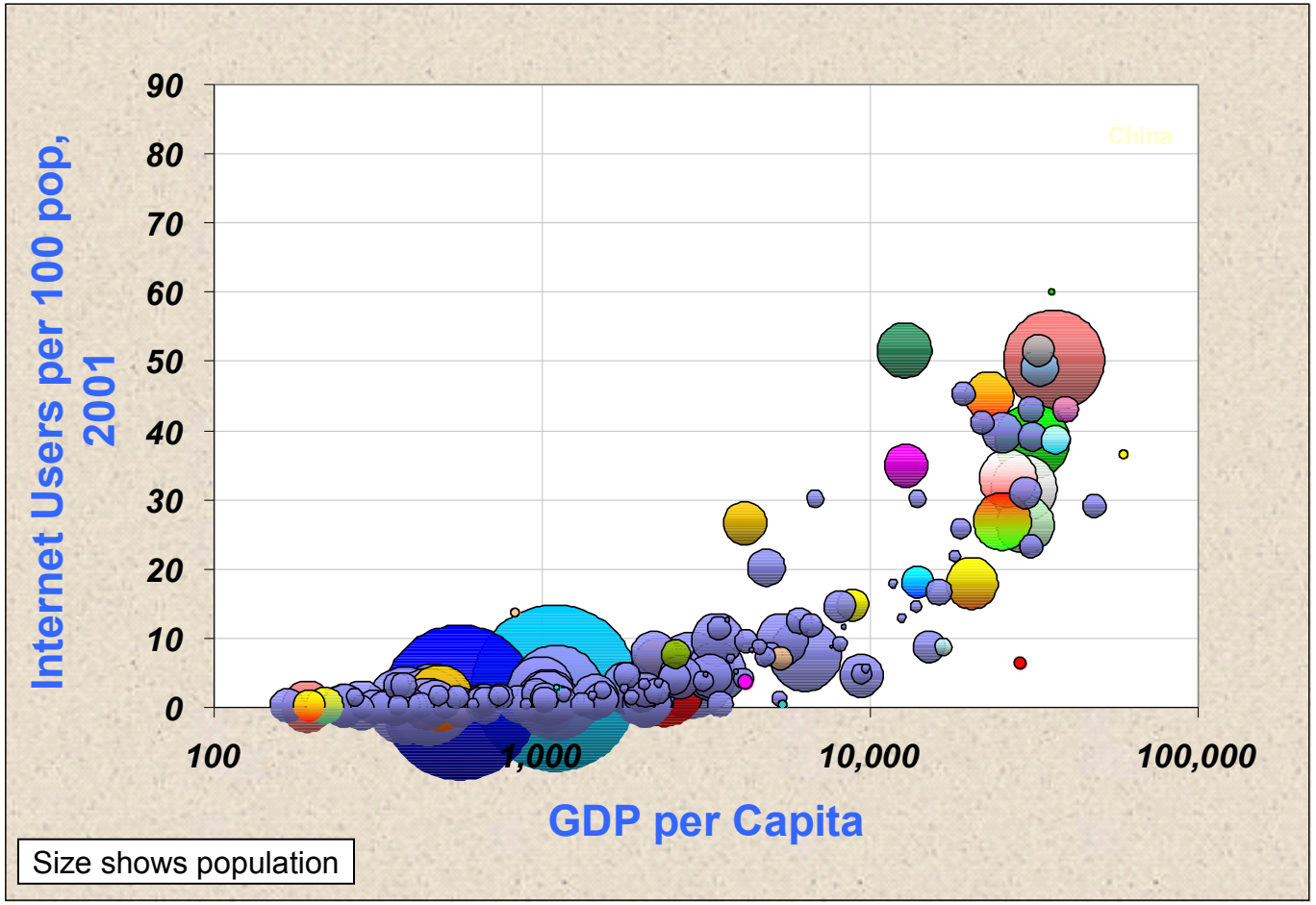

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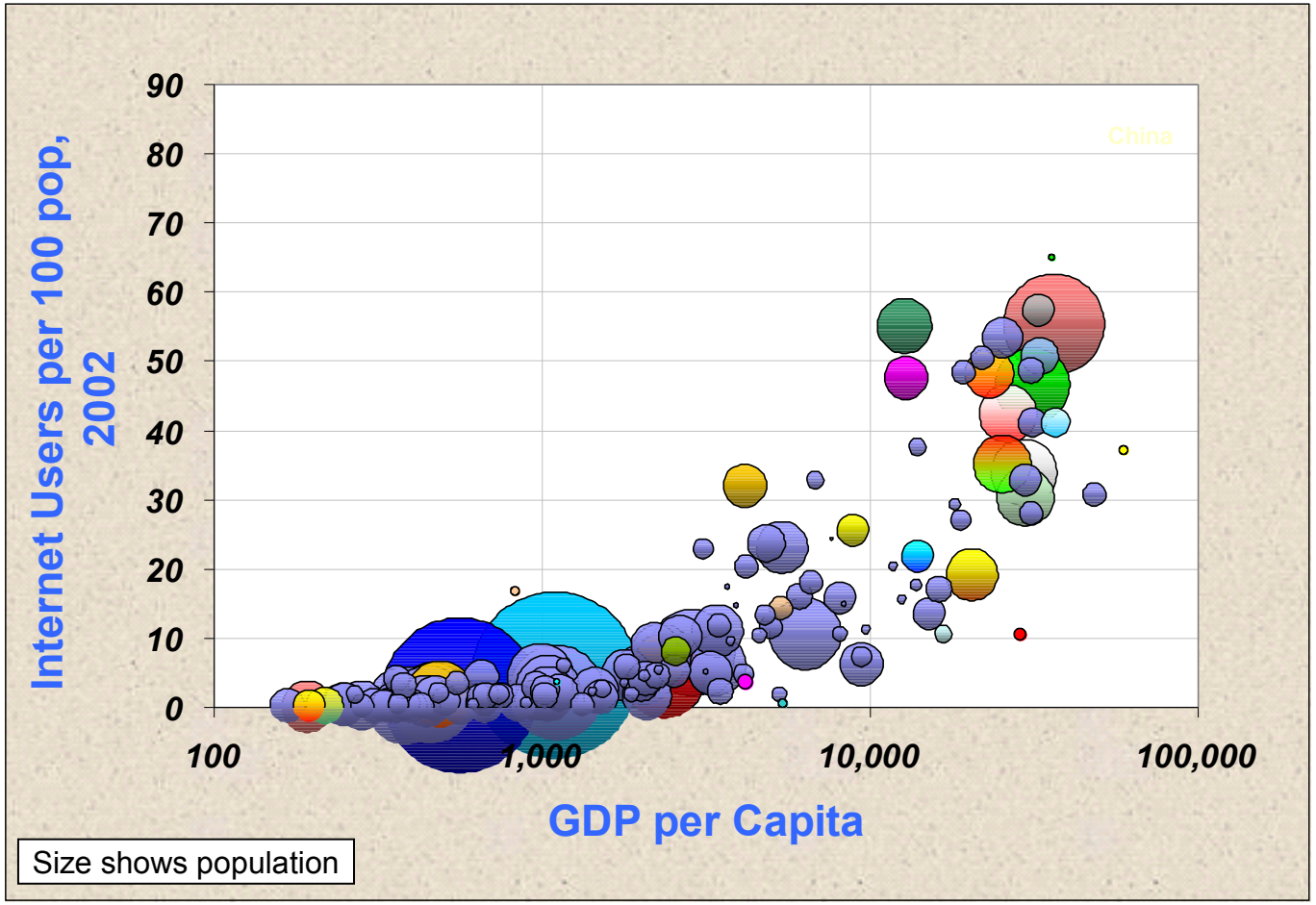

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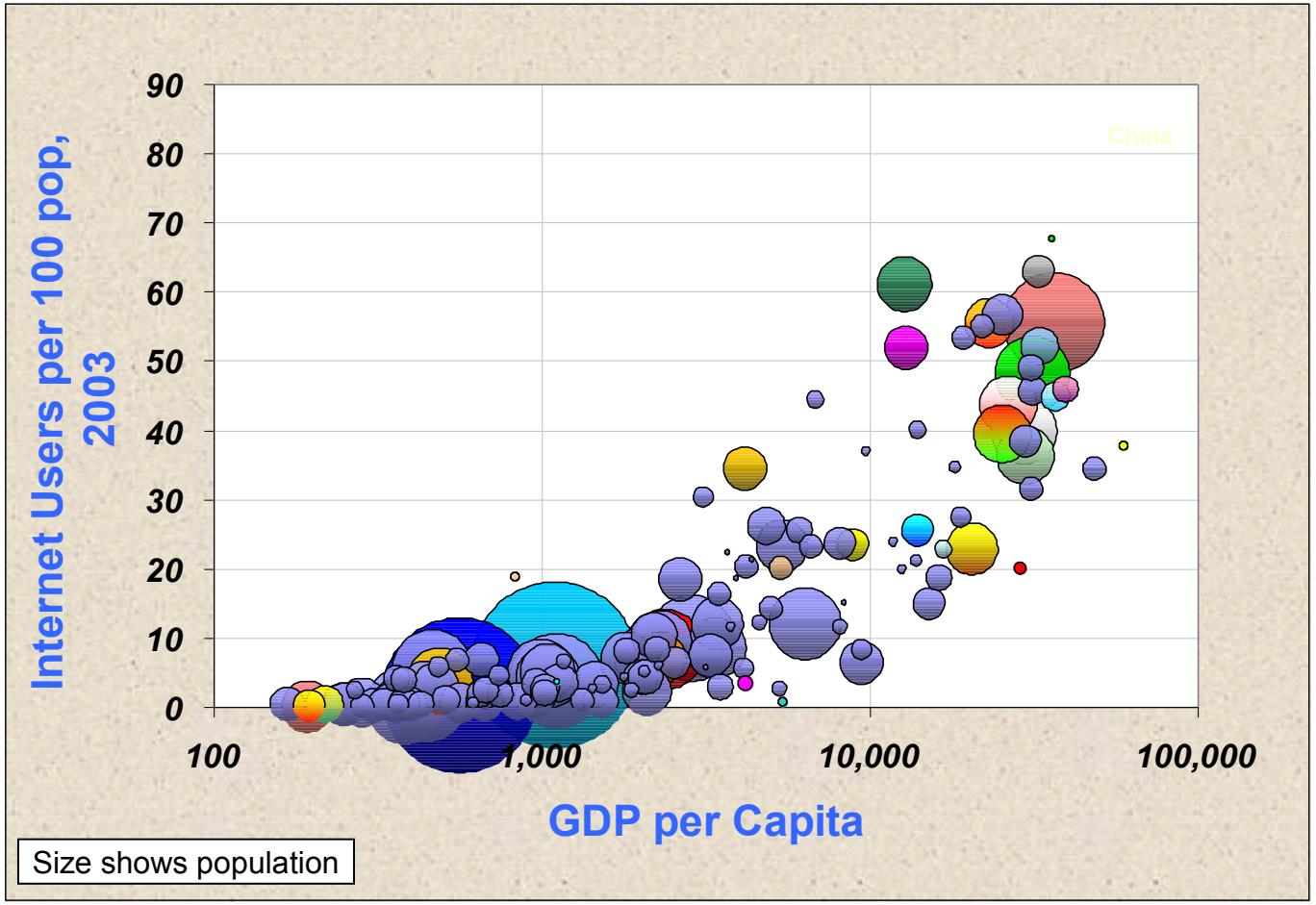

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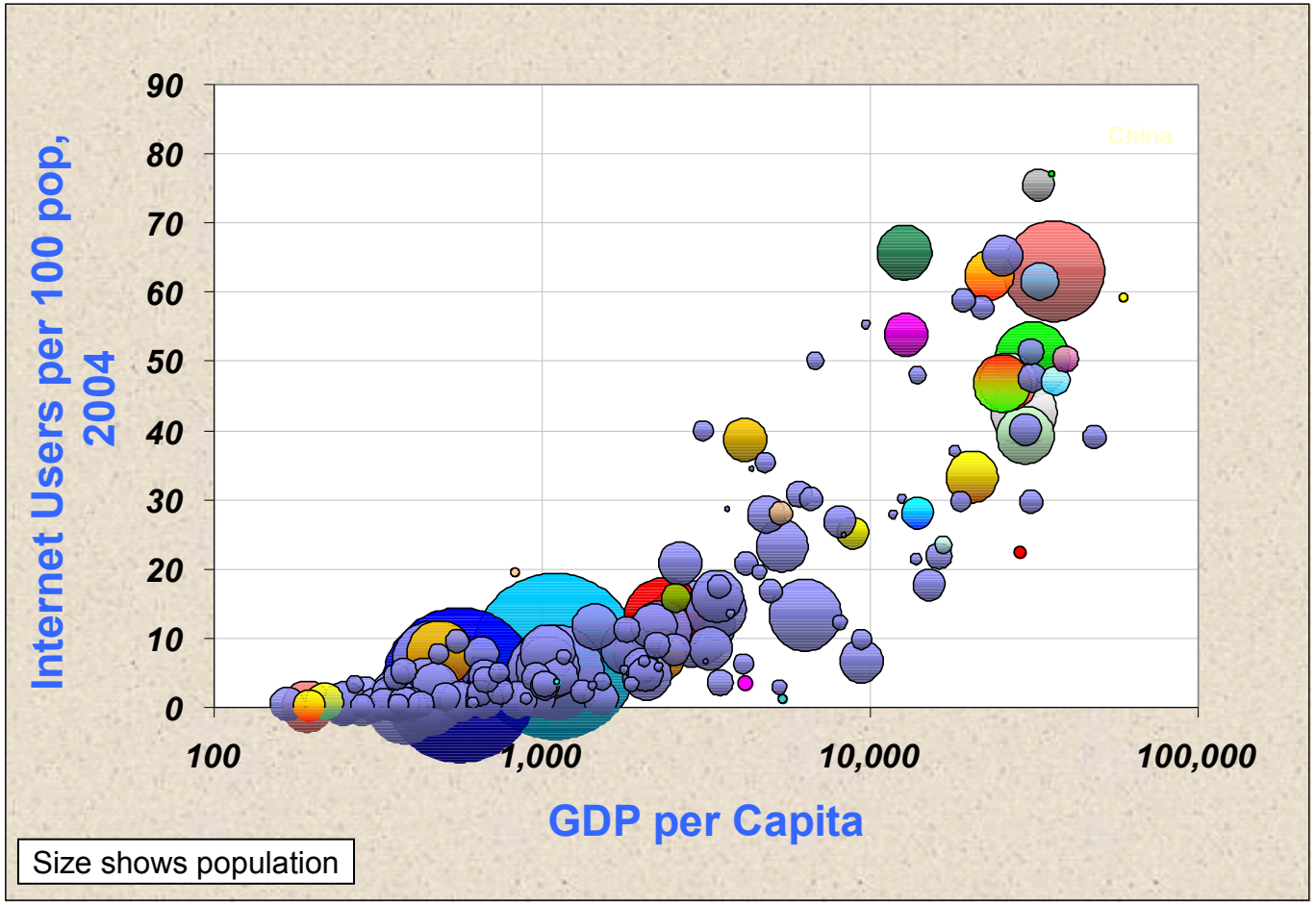

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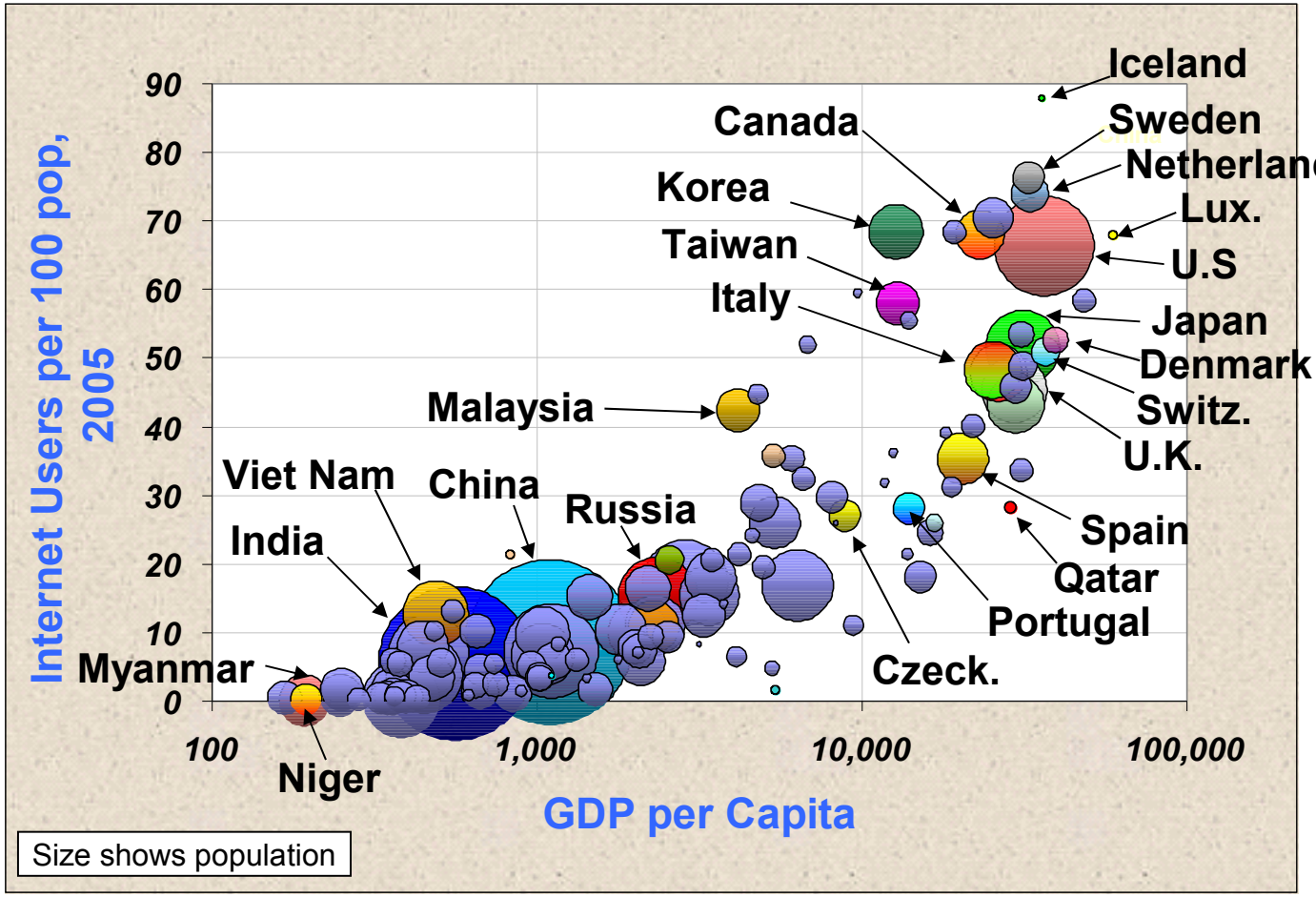

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Background - Broadband Subscribers

- Broadband Subscribers per 100 population

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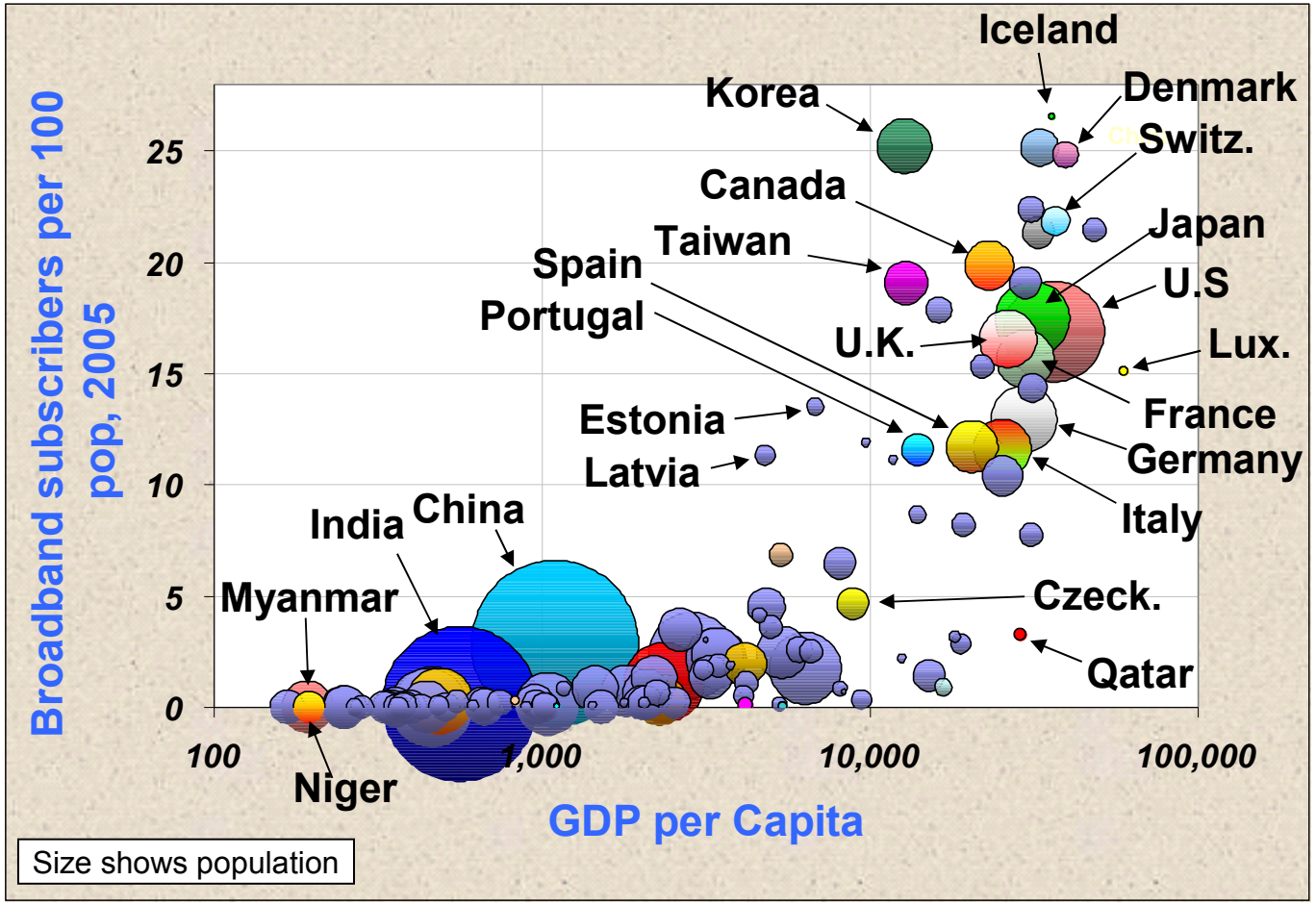
Background

Broadband Subscribers per 100 pop. in 2005



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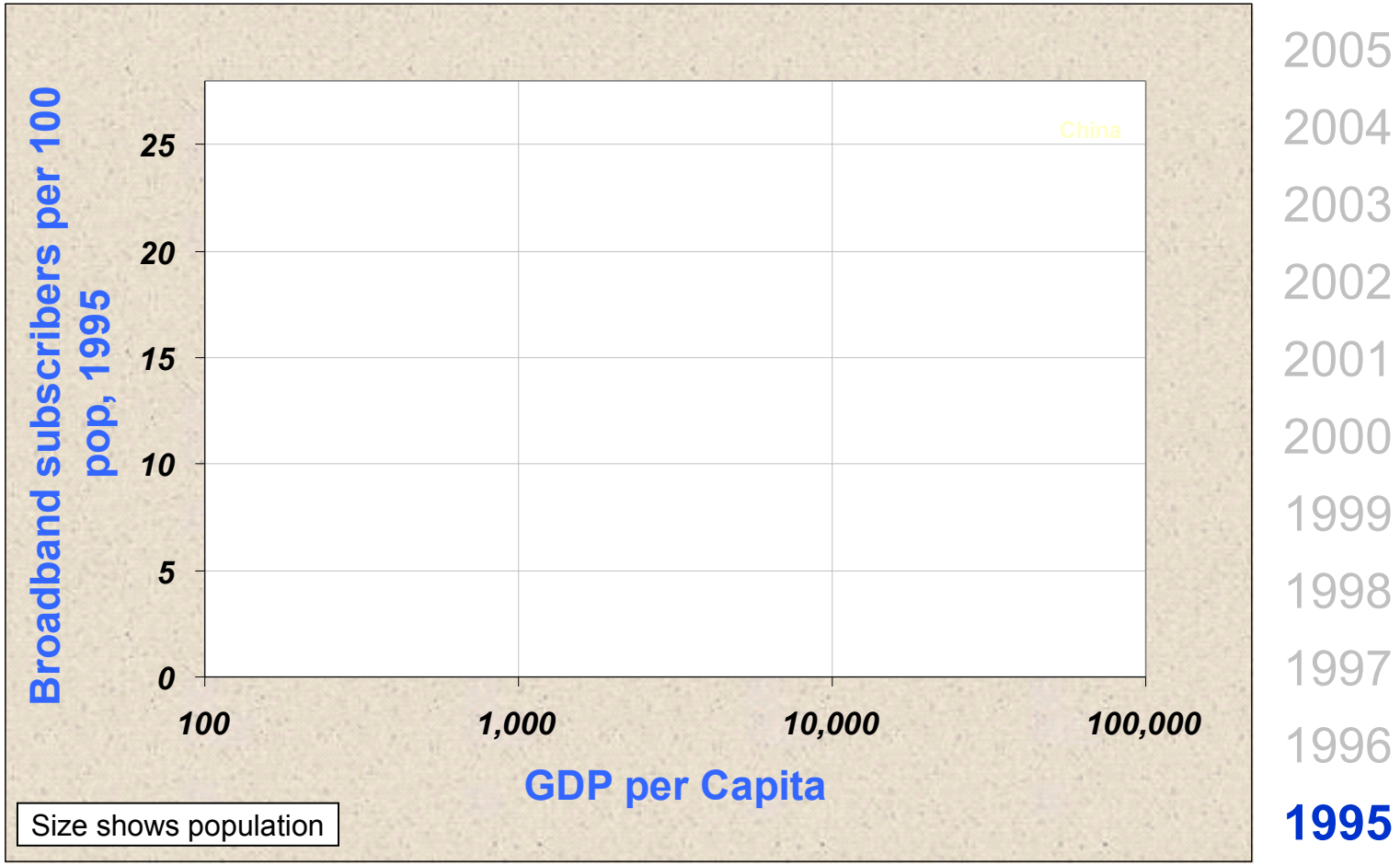

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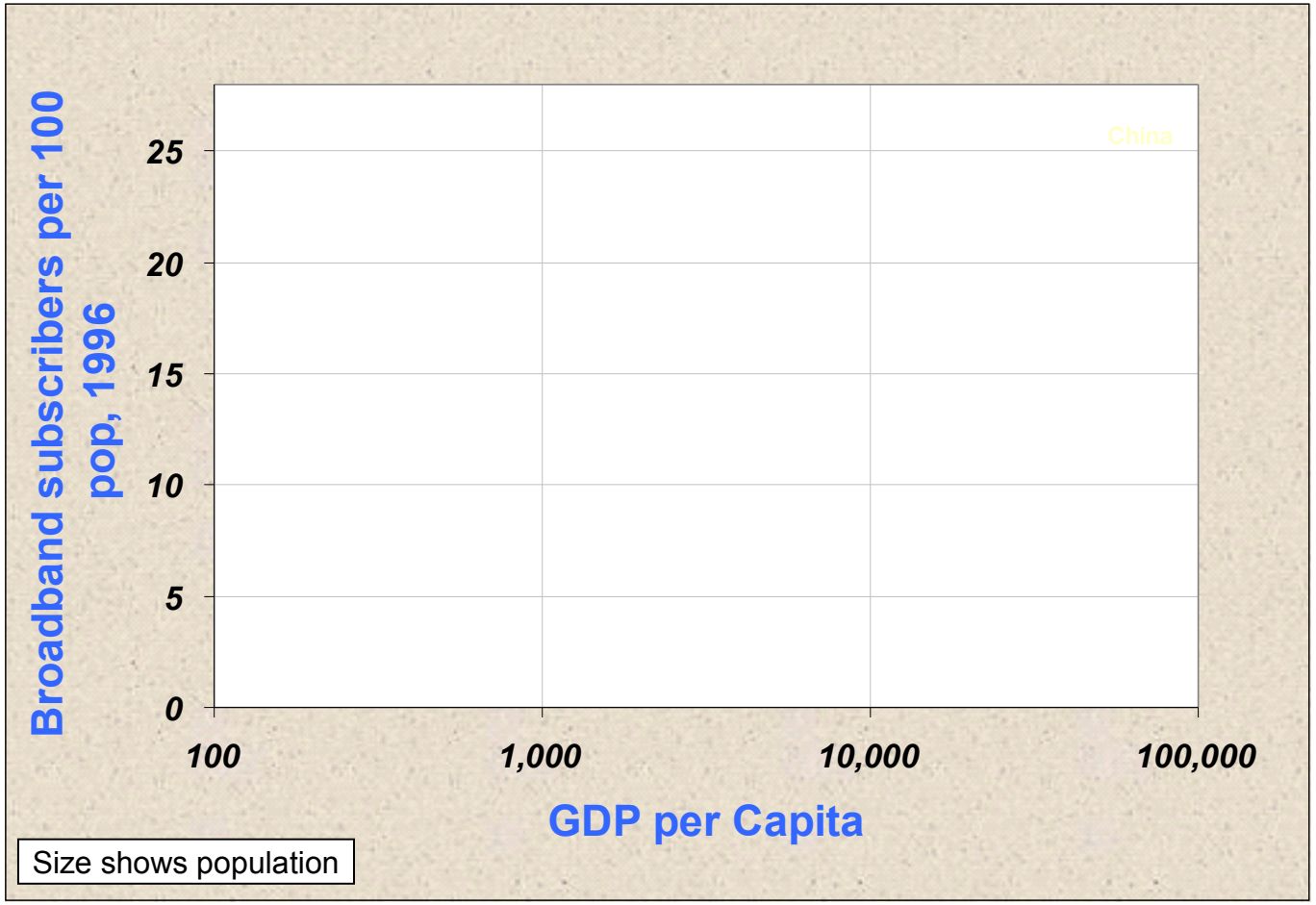

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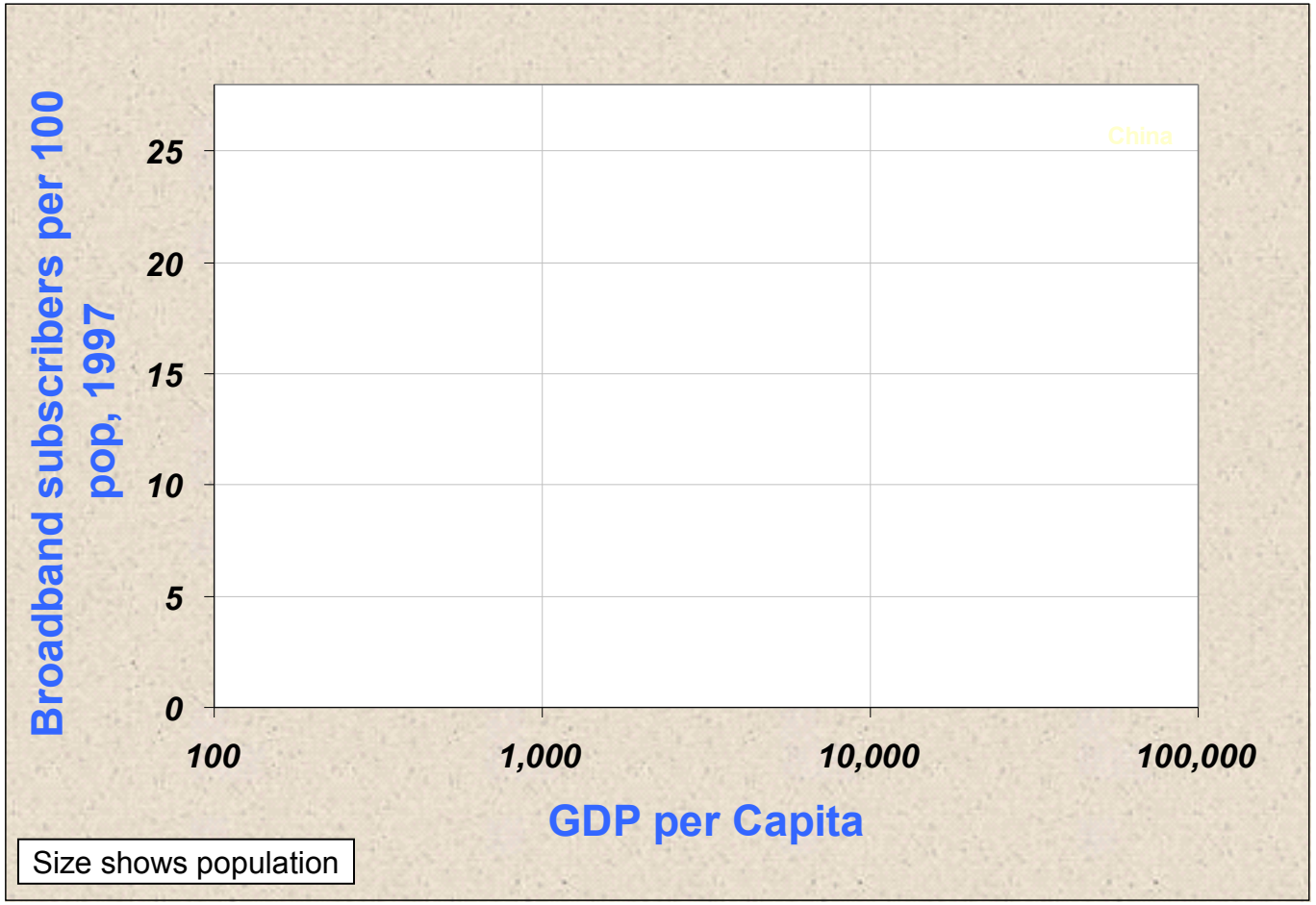

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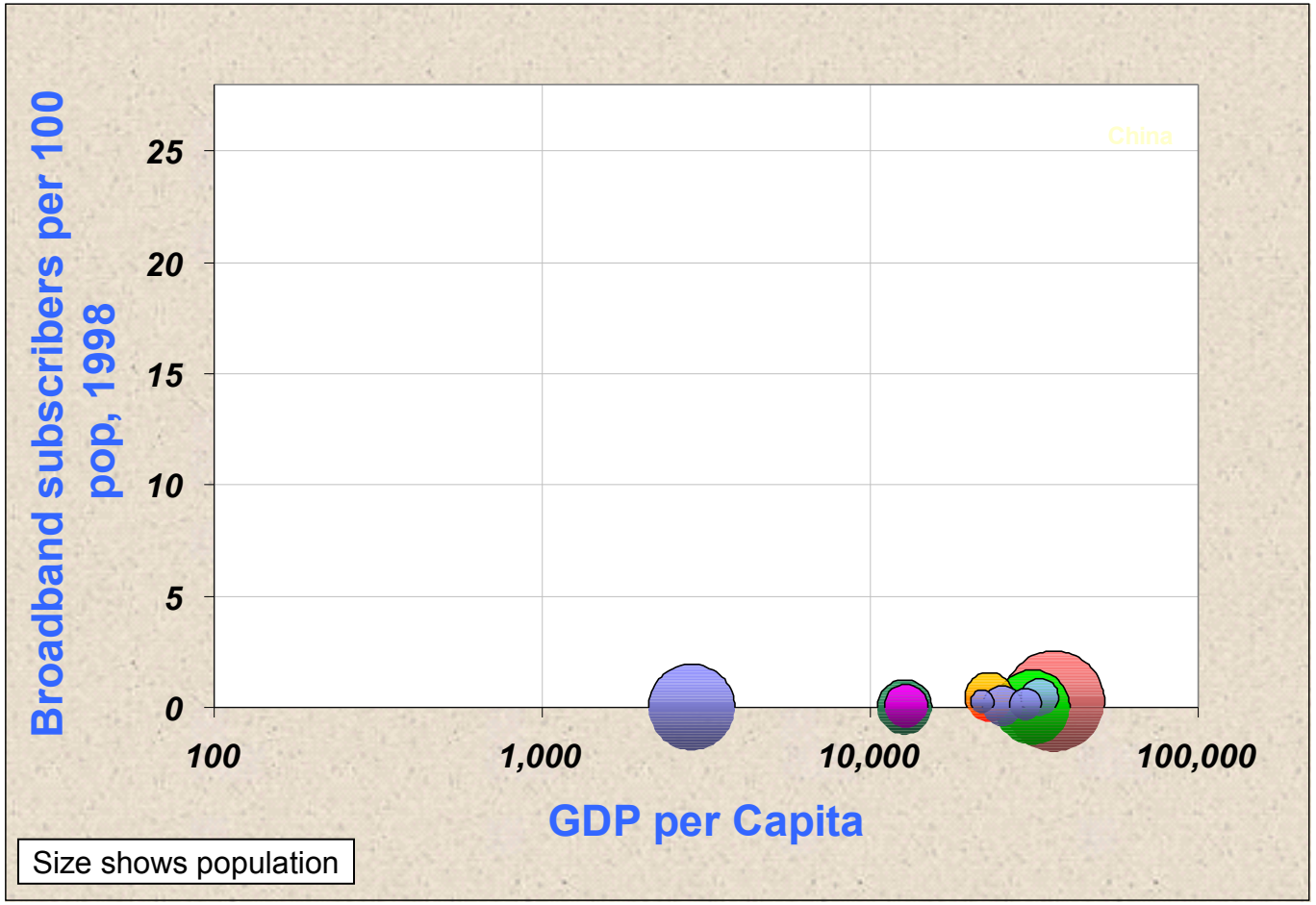

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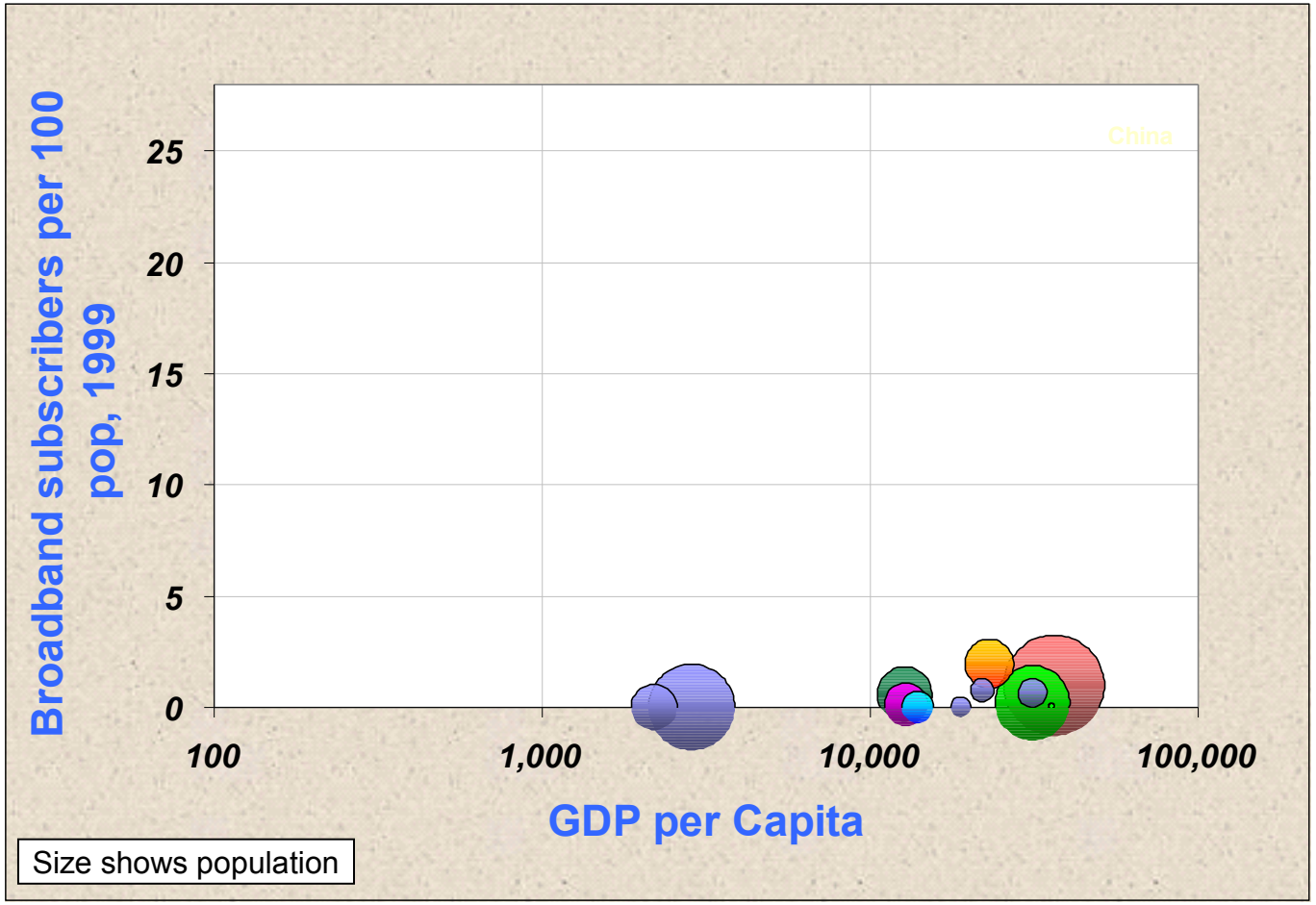

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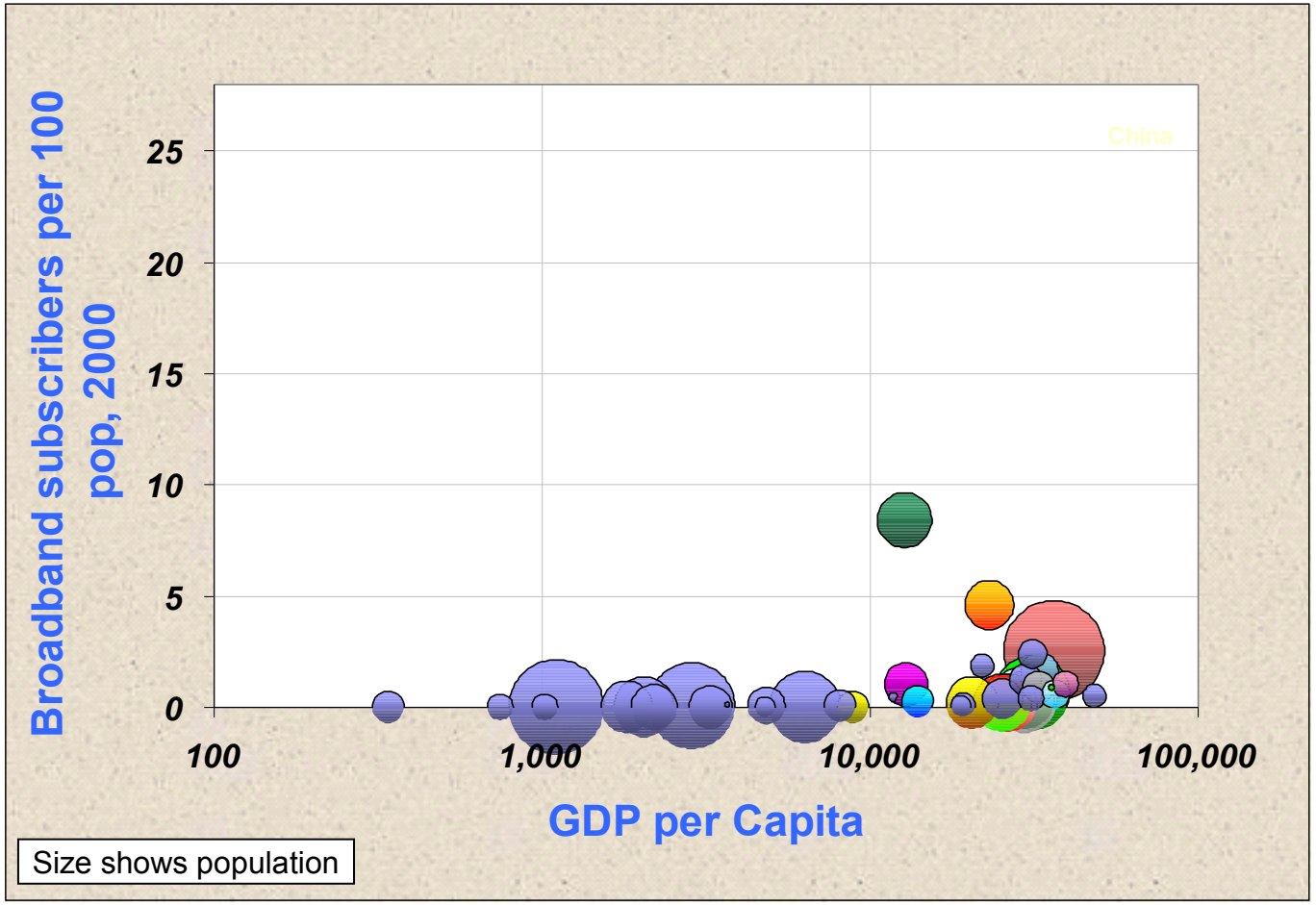

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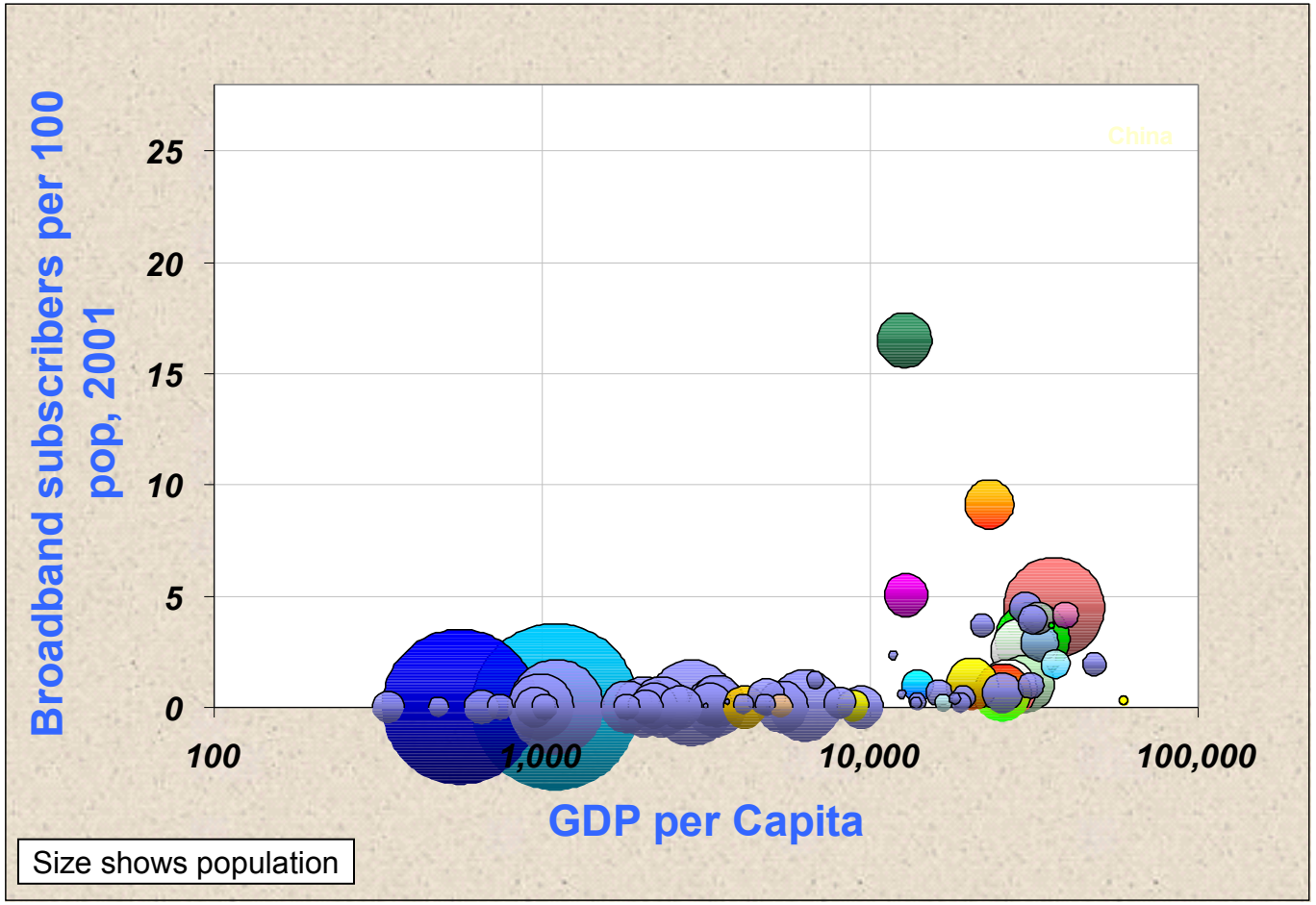

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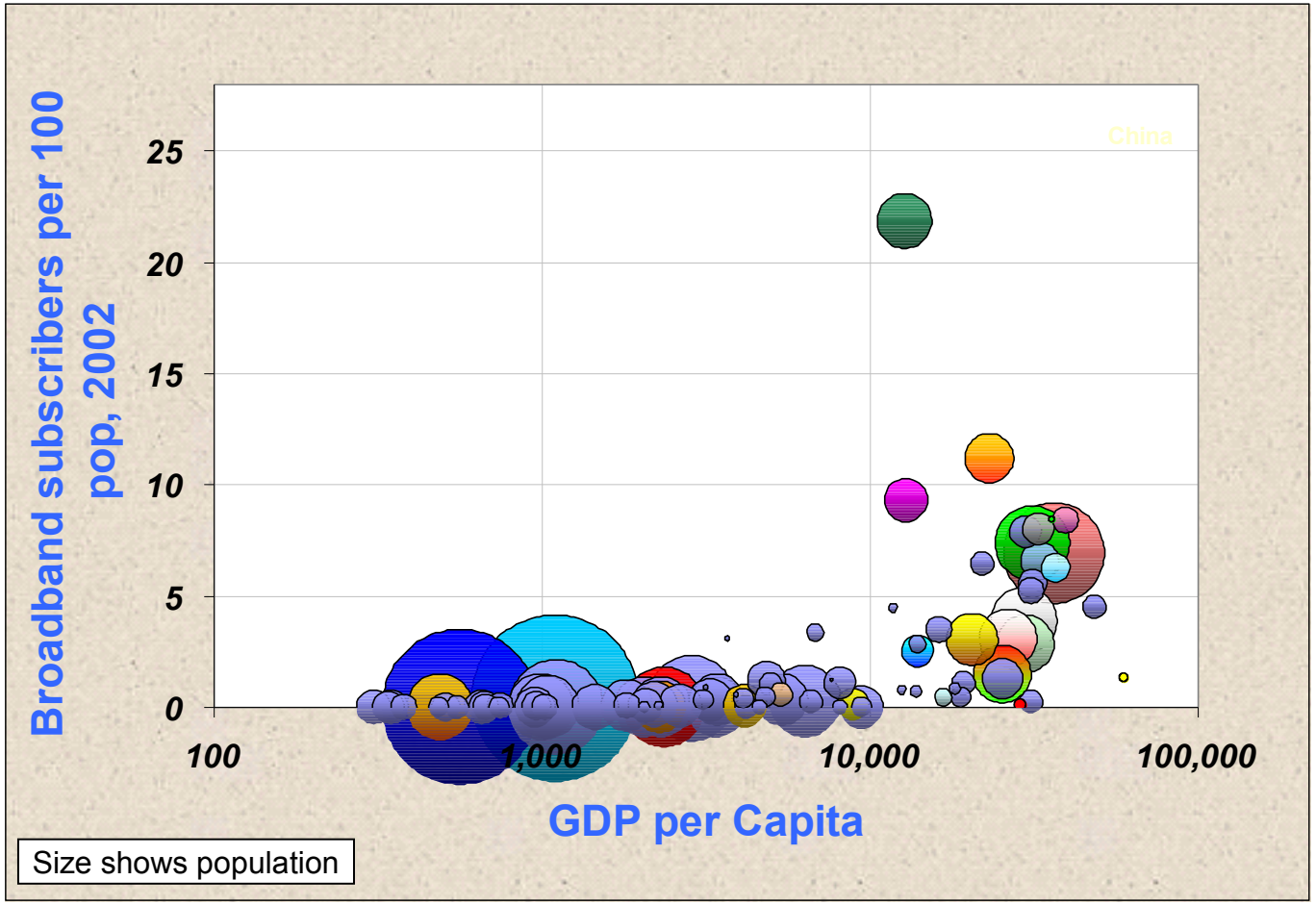

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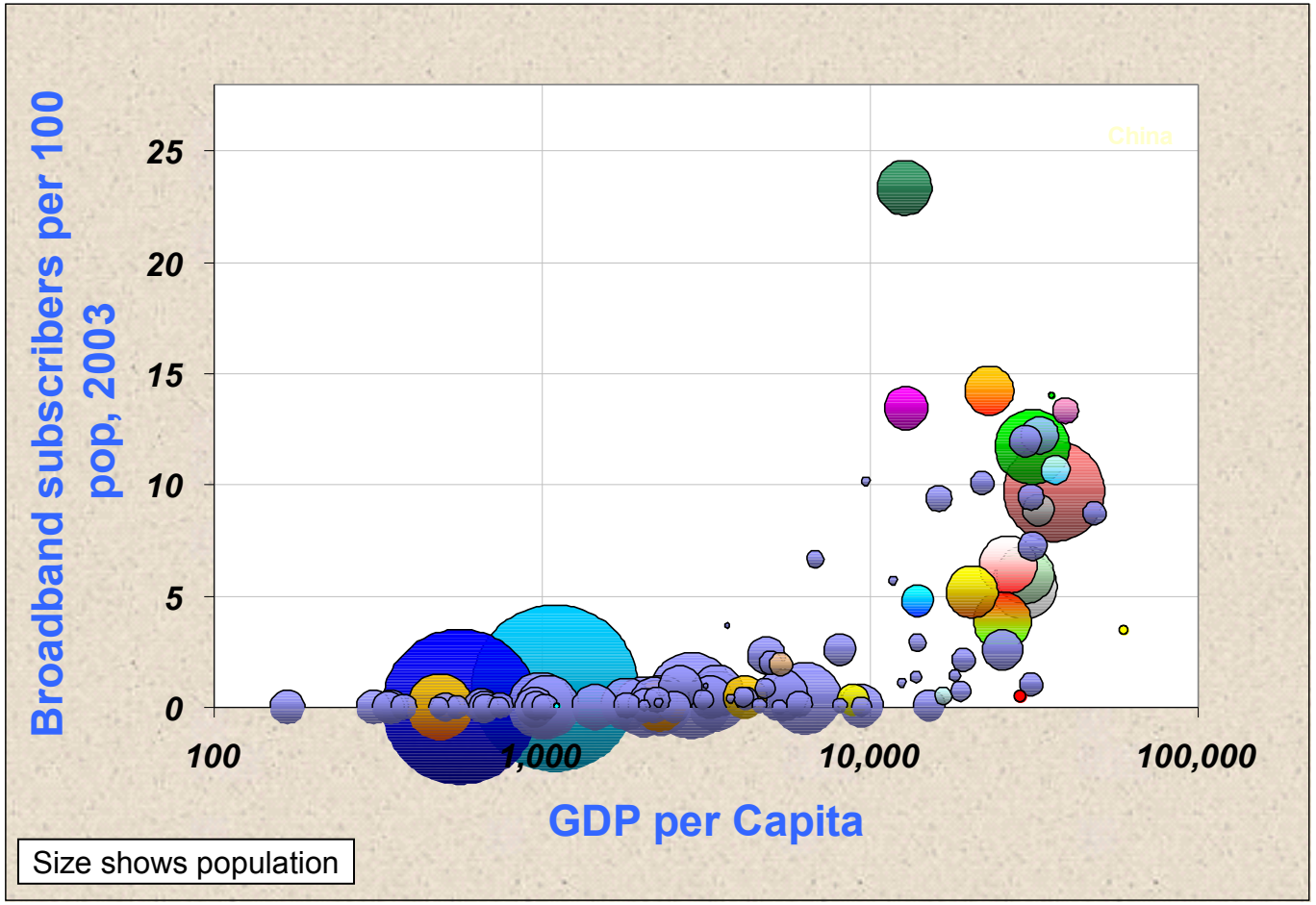

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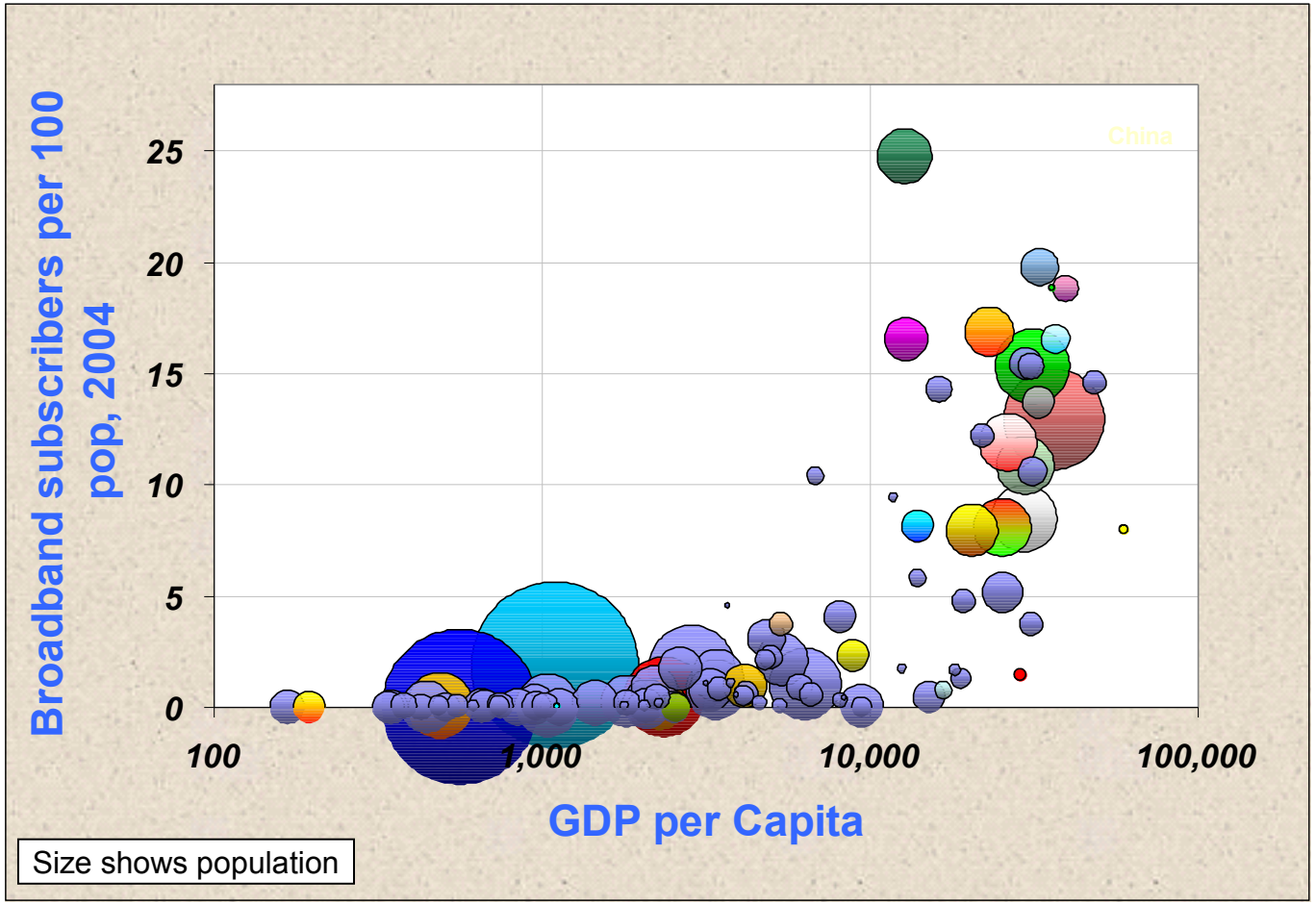

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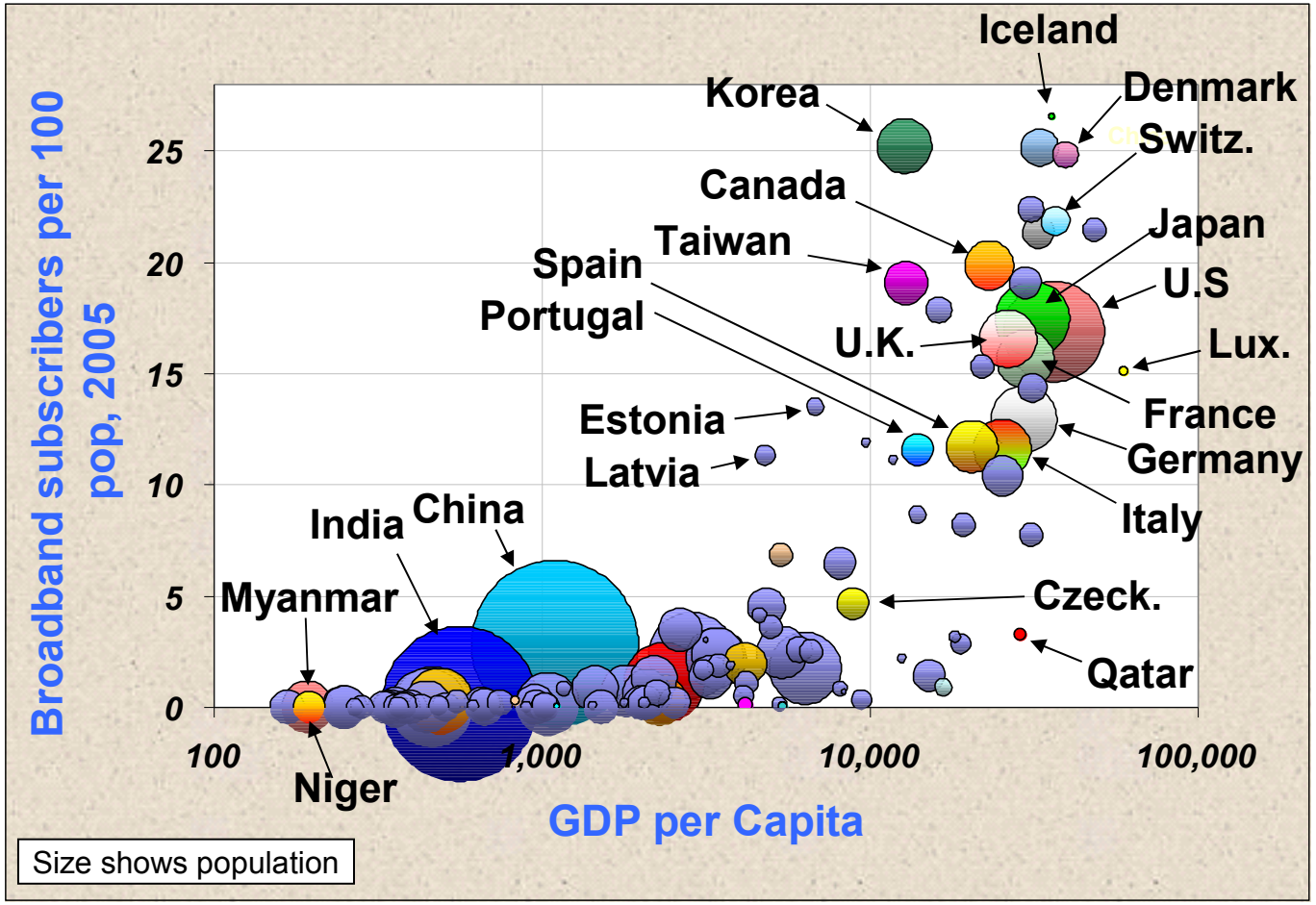

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Technologies

Basic Ingredients

- Computing & Processing
- Storage & Retrieval
- Networks & Interconnects
  - Wired, Optical, Cable, Wireless
- Software & Architectures
- Displays & User Devices
- Information & Content

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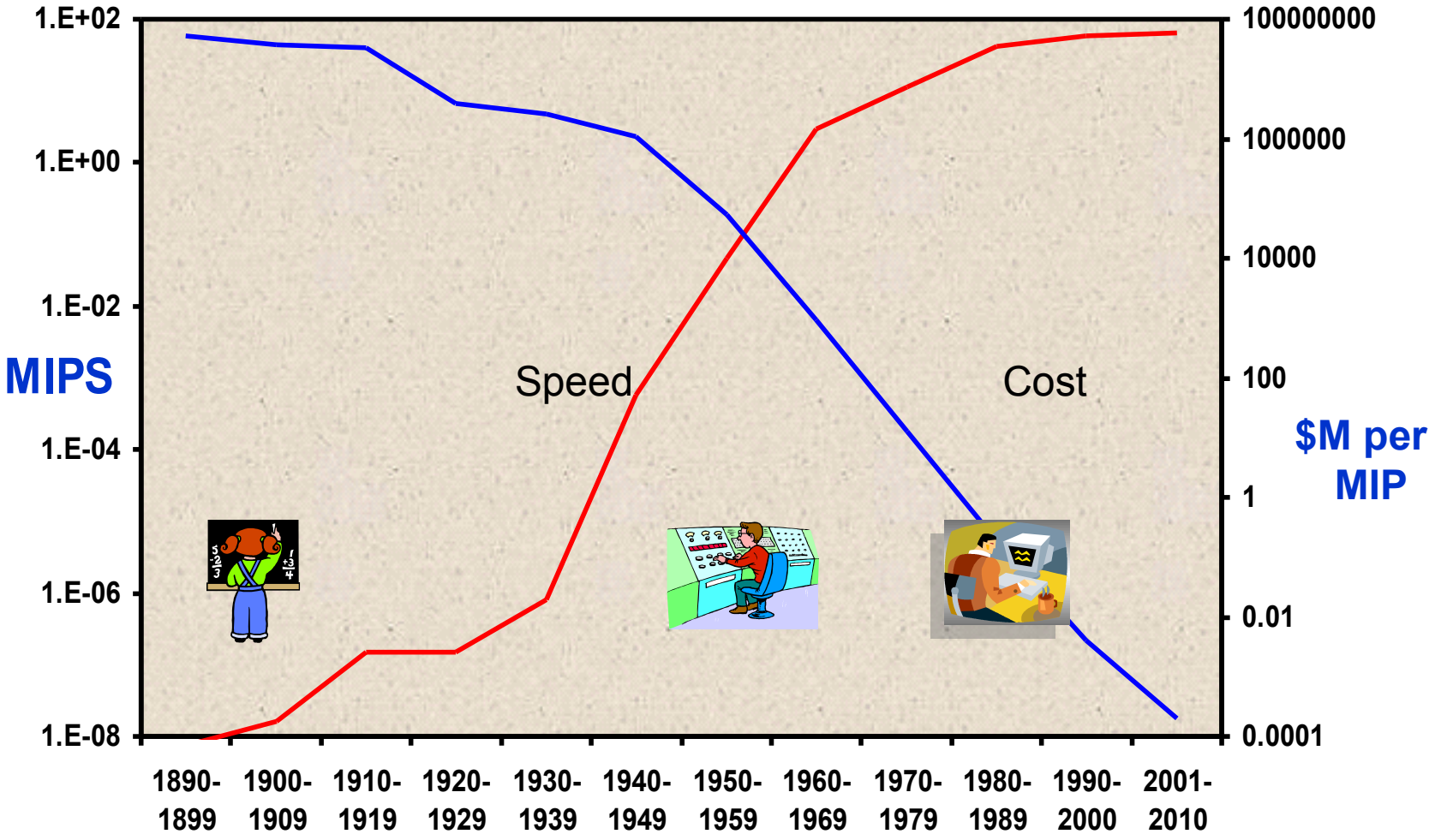
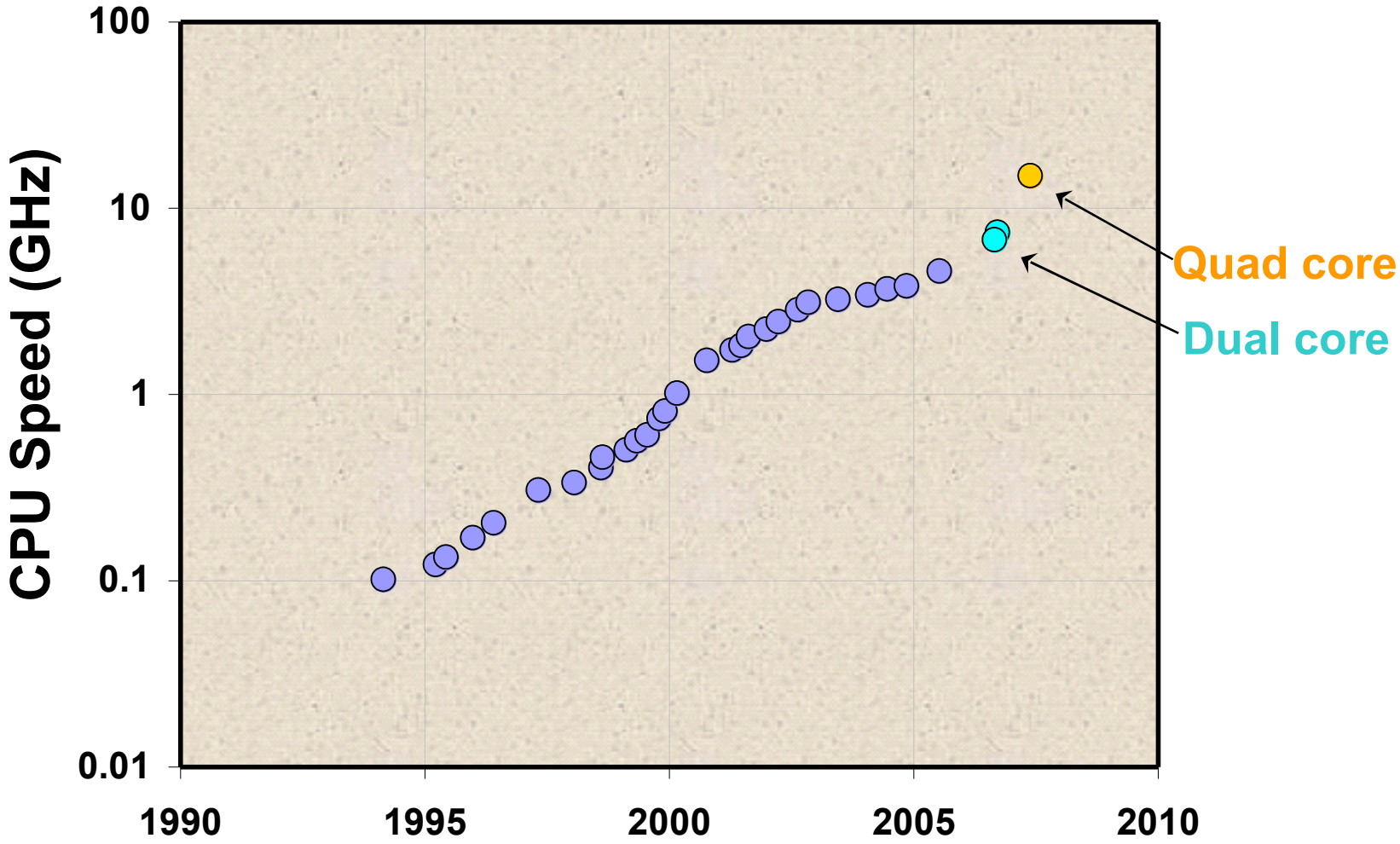
Technologies: Computing

Speed and Cost



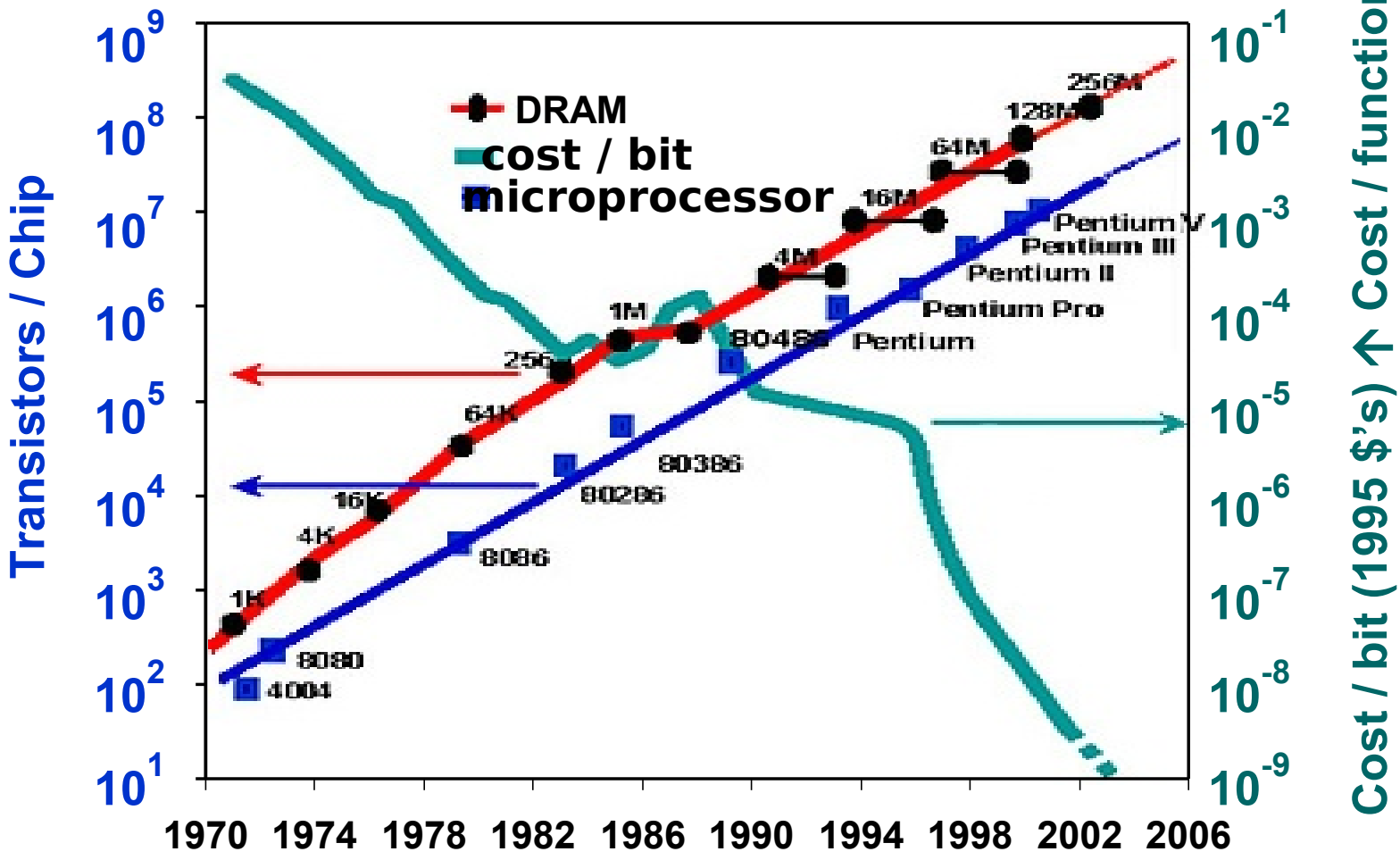
Technologies: CPU Speed (Intel)

Maximum Intel CPU Speed (IA-32) vs. Time



Ref: http://wi-fizzle.com/compsci/ and Intel

Technologies: Chip Evolution



http://ocw.mit.edu/OcwWeb/Electrical-Engineering-and-Computer-Science/6-012Fall2003/CourseHome/index.htm

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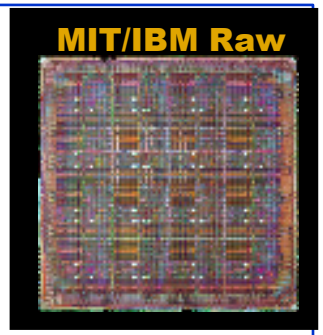
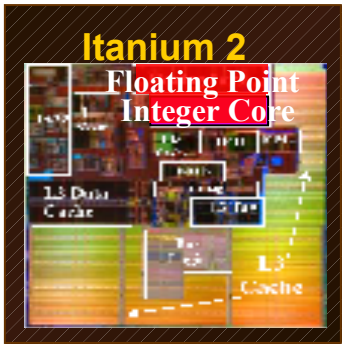
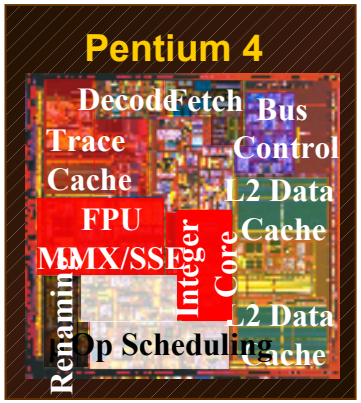
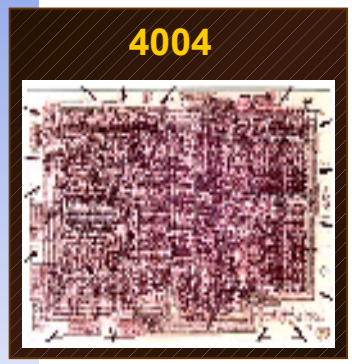
Technologies: Moore's Law-

From single transistors to CMP









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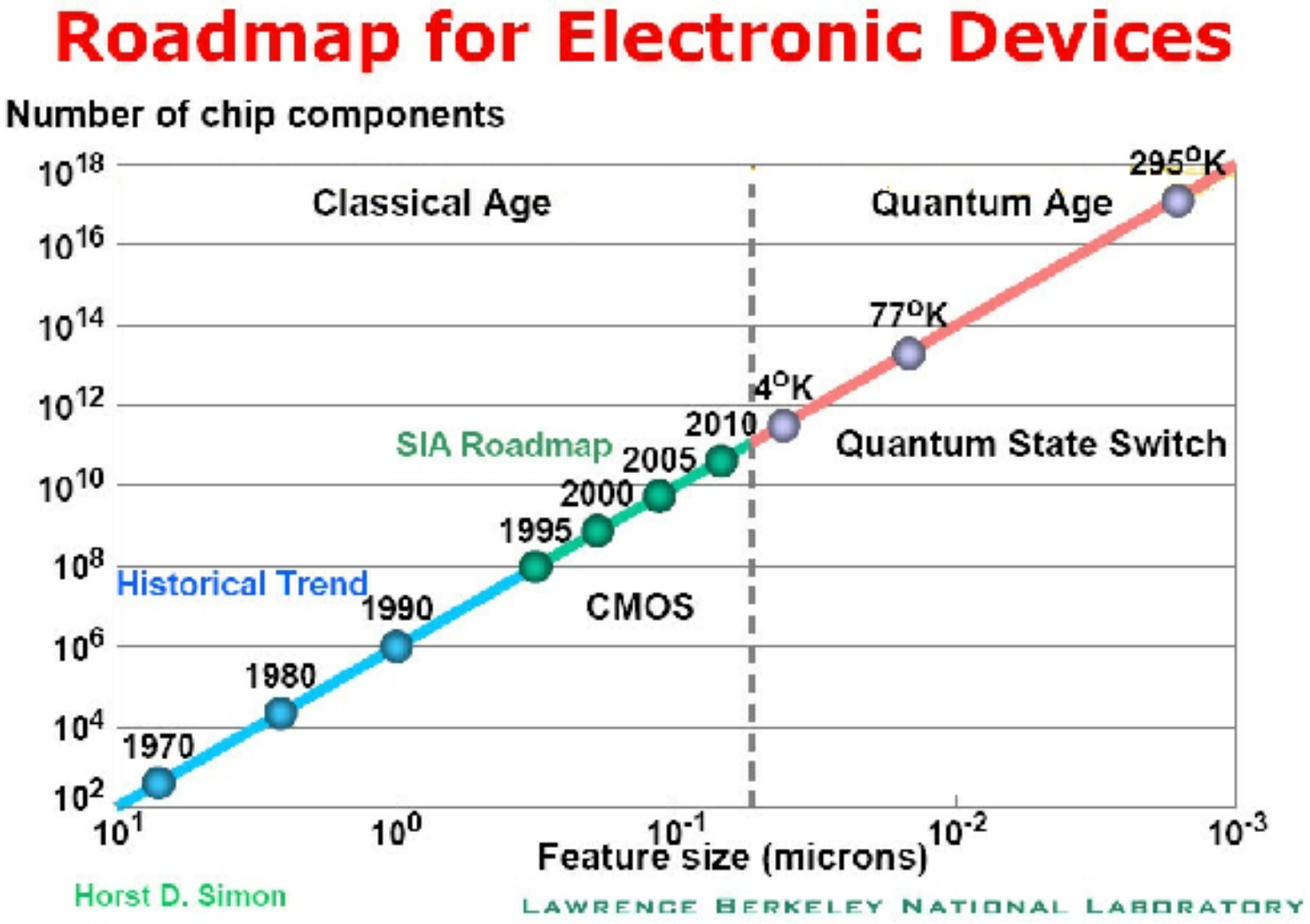
Technologies: Electronic Devices



http://ocw.mit.edu/NR/rdonlyres/Sloan-School-of-Management/15-769Operations-StrategySpring2003/F661B929-CF25-4D00-94BD-5FFC0EA1C750/0/roadmapwkshp.pdf (p53)

Technologies: Chip Densities, Clock Rates

International Technology Roadmap for Semiconductors

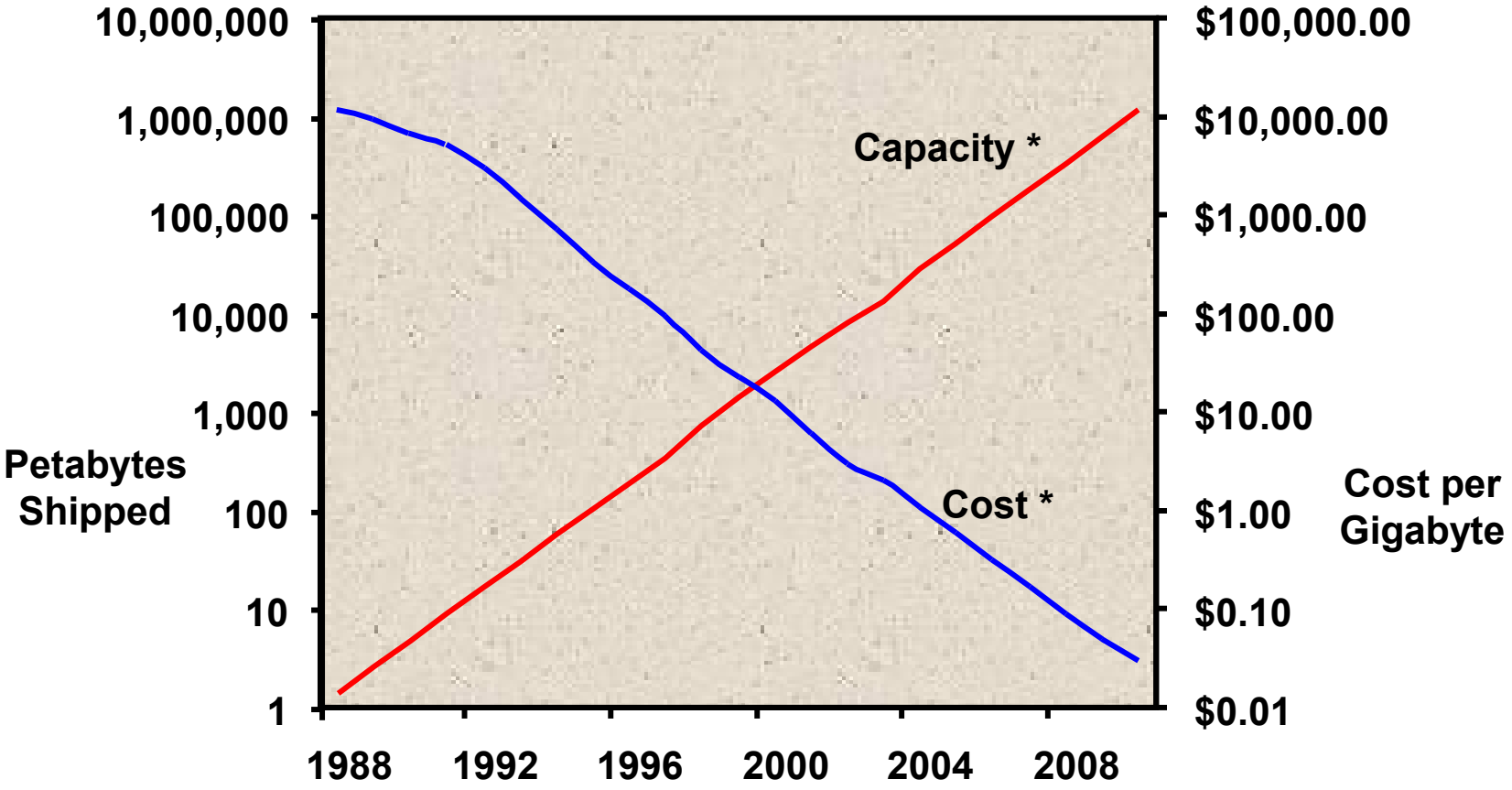
Year	2005	2008	2011	2014
Technology (nm)	100	70	50	35
DRAM chip area (mm^2)	526	603	691	792
DRAM capacity (Gb)	8		64	
MPU chip area (mm^2)	622	713	817	937
MPU transistors ($x10^6$)	0.9	2.5	7.0	20.0
MPU Clock Rate (GHz)	3.5	6.0	10.0	13.5

source

http://ocw.mit.edu/NR/rdonlyres/Sloan-School-of-Management/15-769Operations-StrategySpring2003/F661B929-CF25-4D00-94BD-5FFC0EA1C750/0/roadmapwkshp.pdf (p53)

Technologies: Storage

Capacity and Cost



Sources: IDC, "1999 Winchester Disk Drive Market Forecast and Review," Wall Street Journal, June 26, 2000
*Telcordia projected capacity 1988-1994 & costs 2003-2010.

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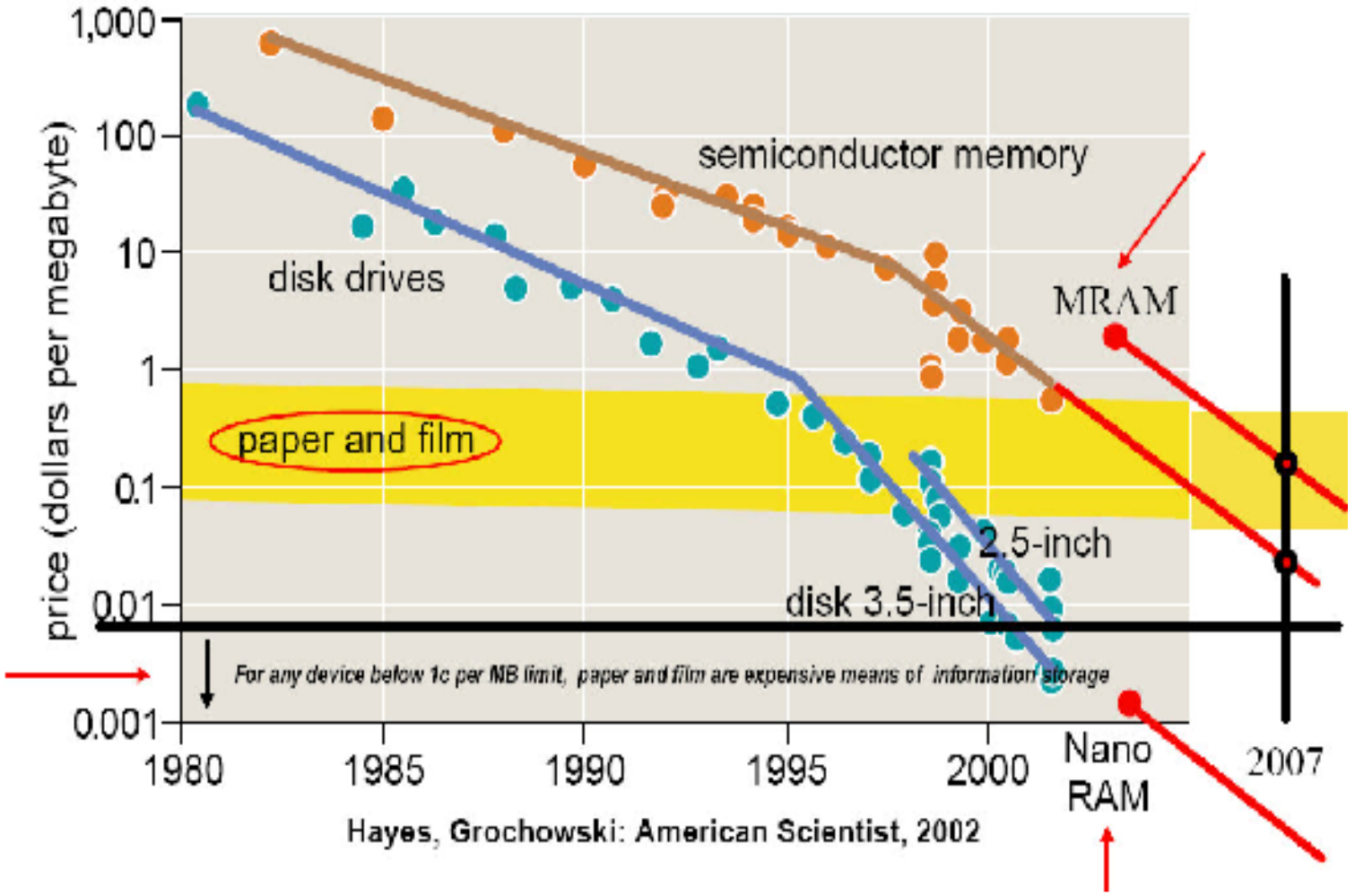
Technologies: Memory

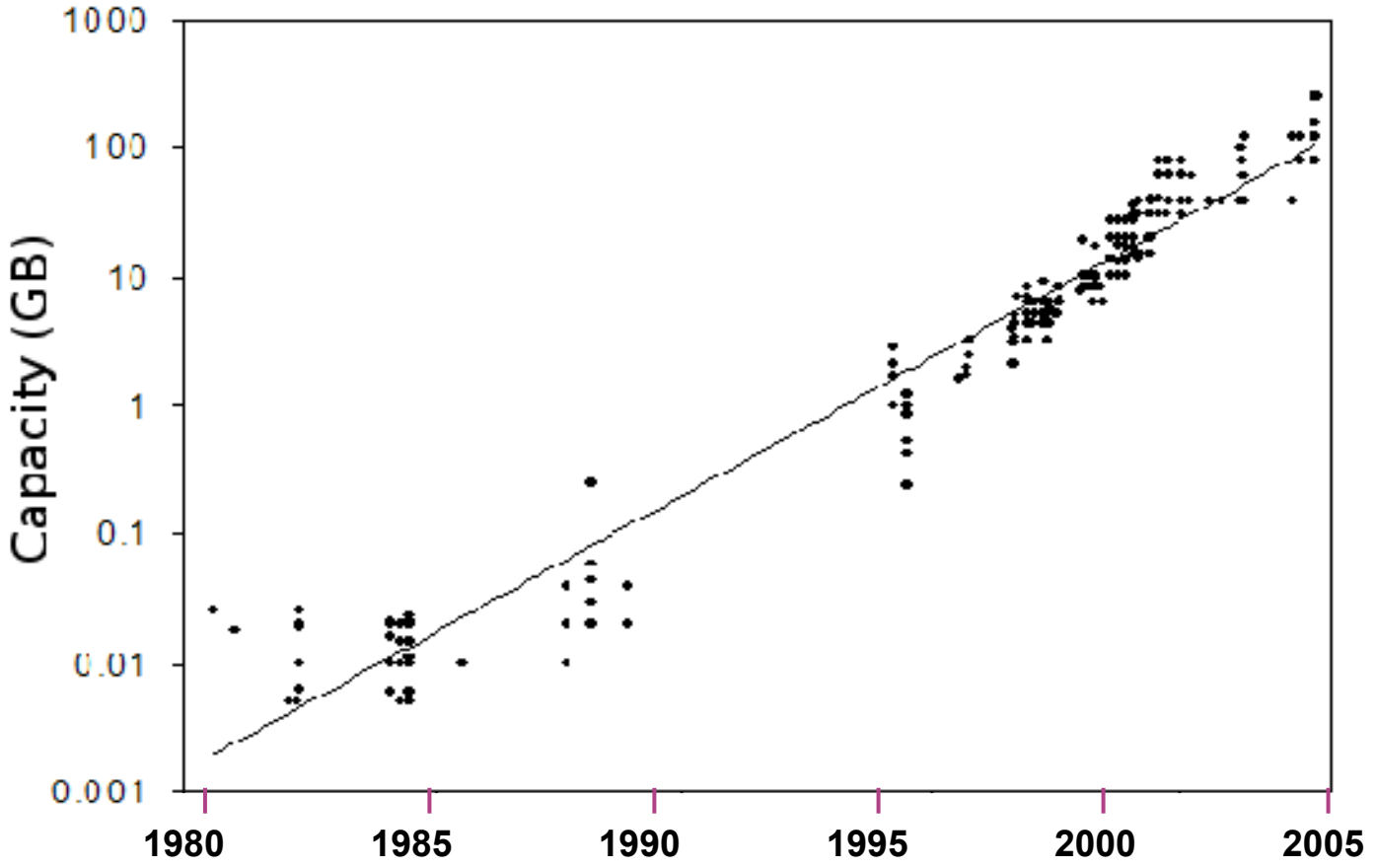
Price per Mb vs. Year (HD & RAM)



http://www.freewebs.com/adipor/Conclusion.pdf

Technologies: Moore's Law

Hard Drive Capacity



http://en.wikipedia.org/wiki/Moore's_law

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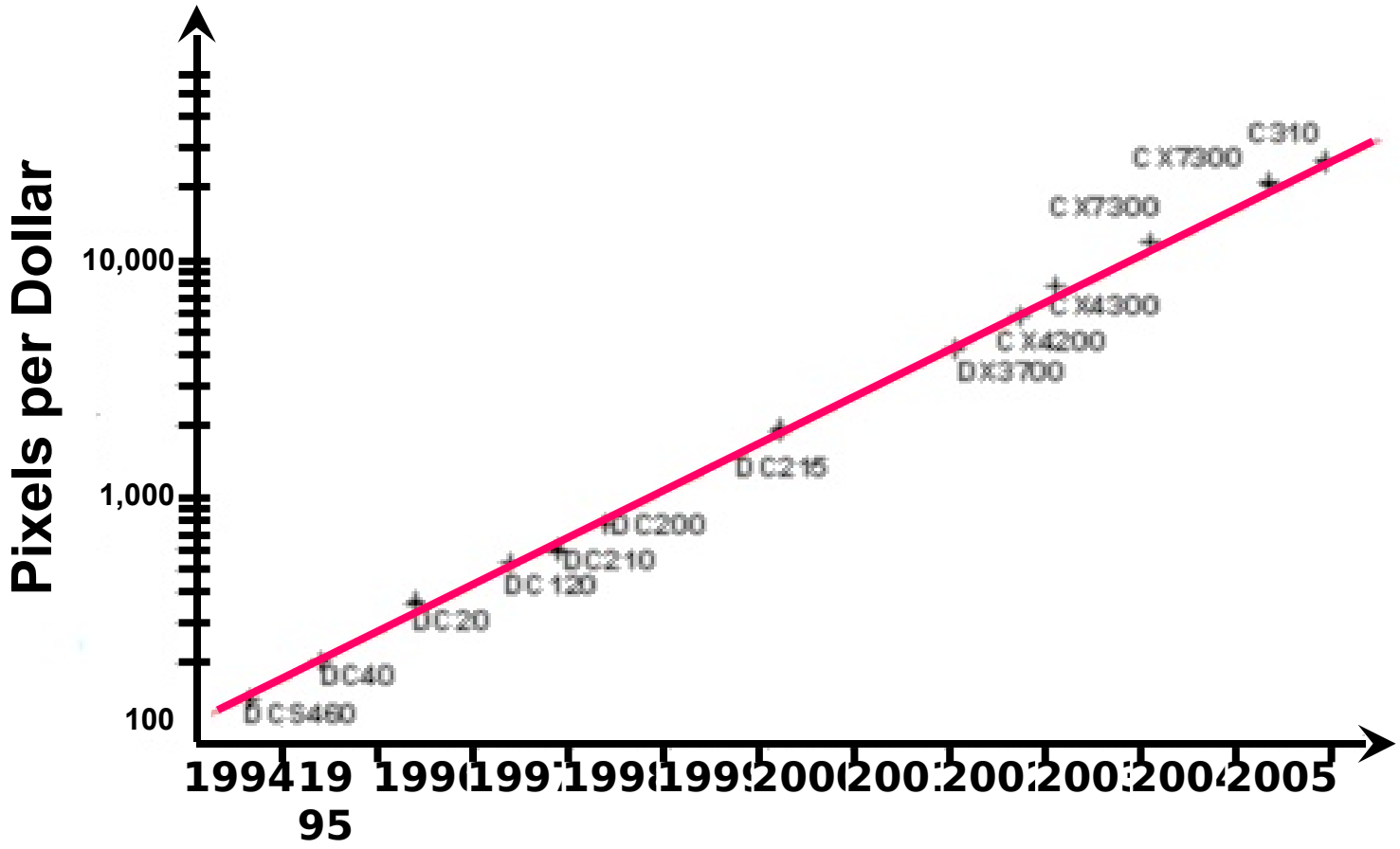
Technologies: Moore's Law

Digital Cameras



http://en.wikipedia.org/wiki/Moore's_law

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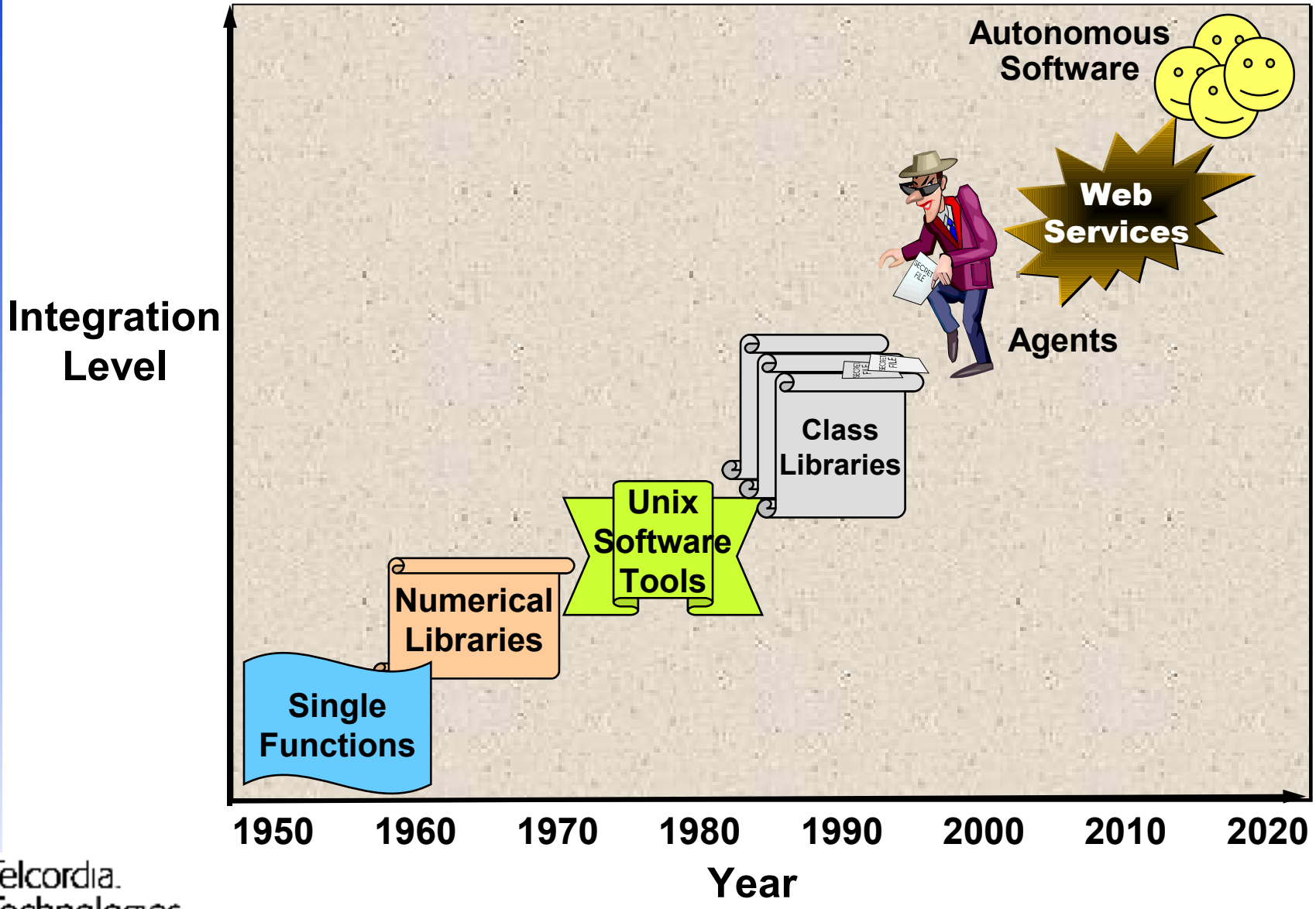
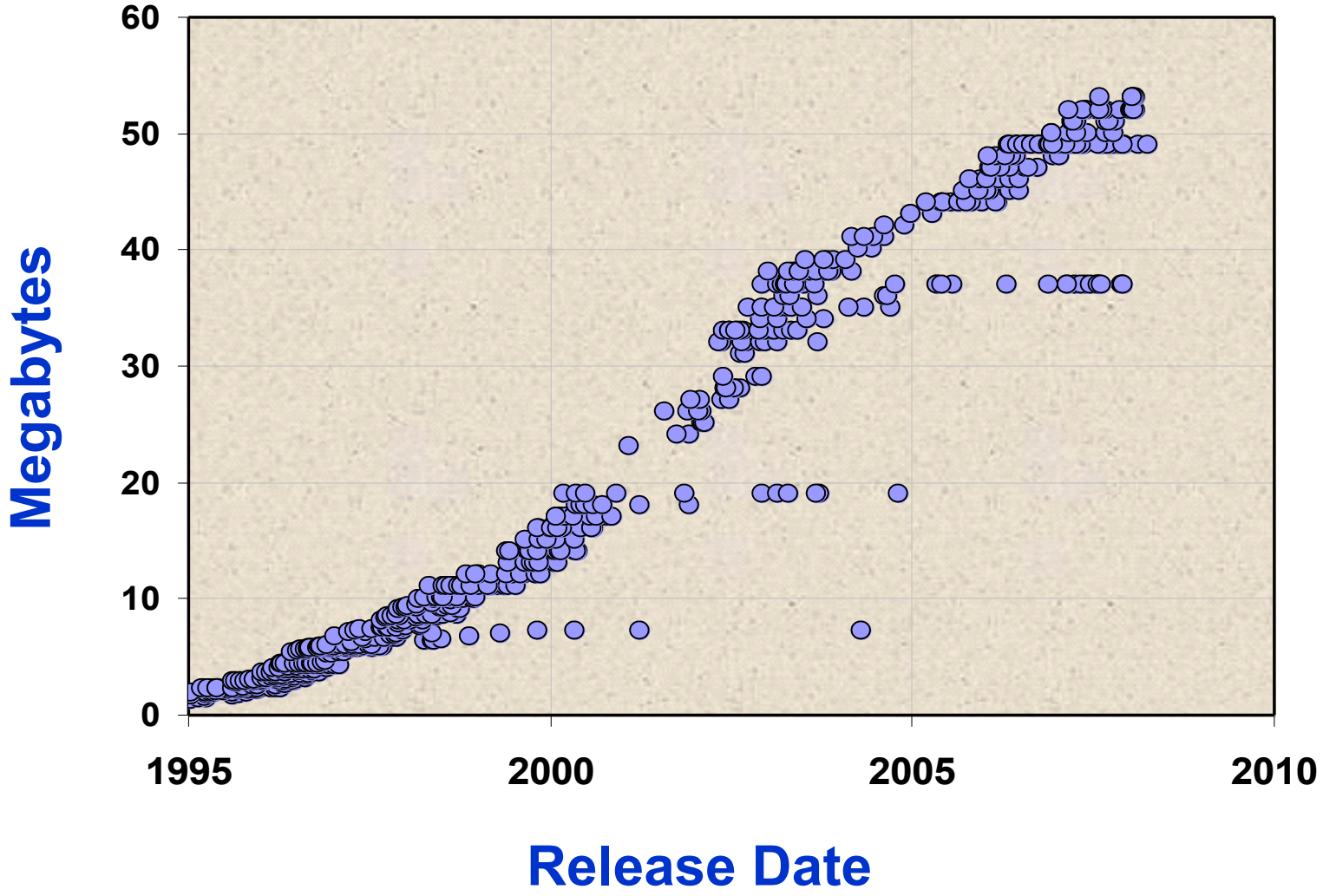
Technologies: Software

Integration Level



Technologies: Software Complexity

Size of Linux Kernel across Releases



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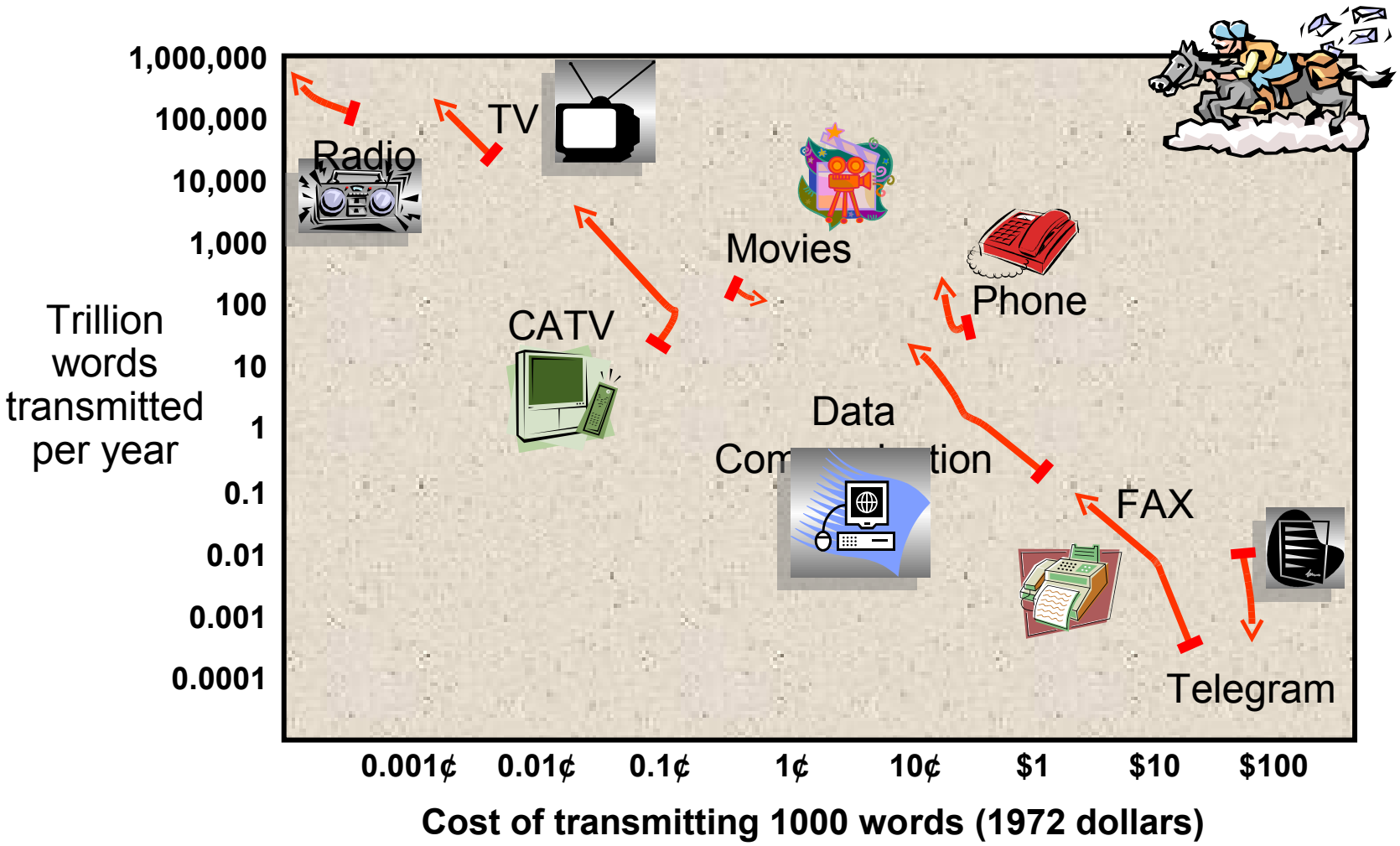
Technologies: Content Delivery

Quantity and Cost (USA 1960 → 2007)



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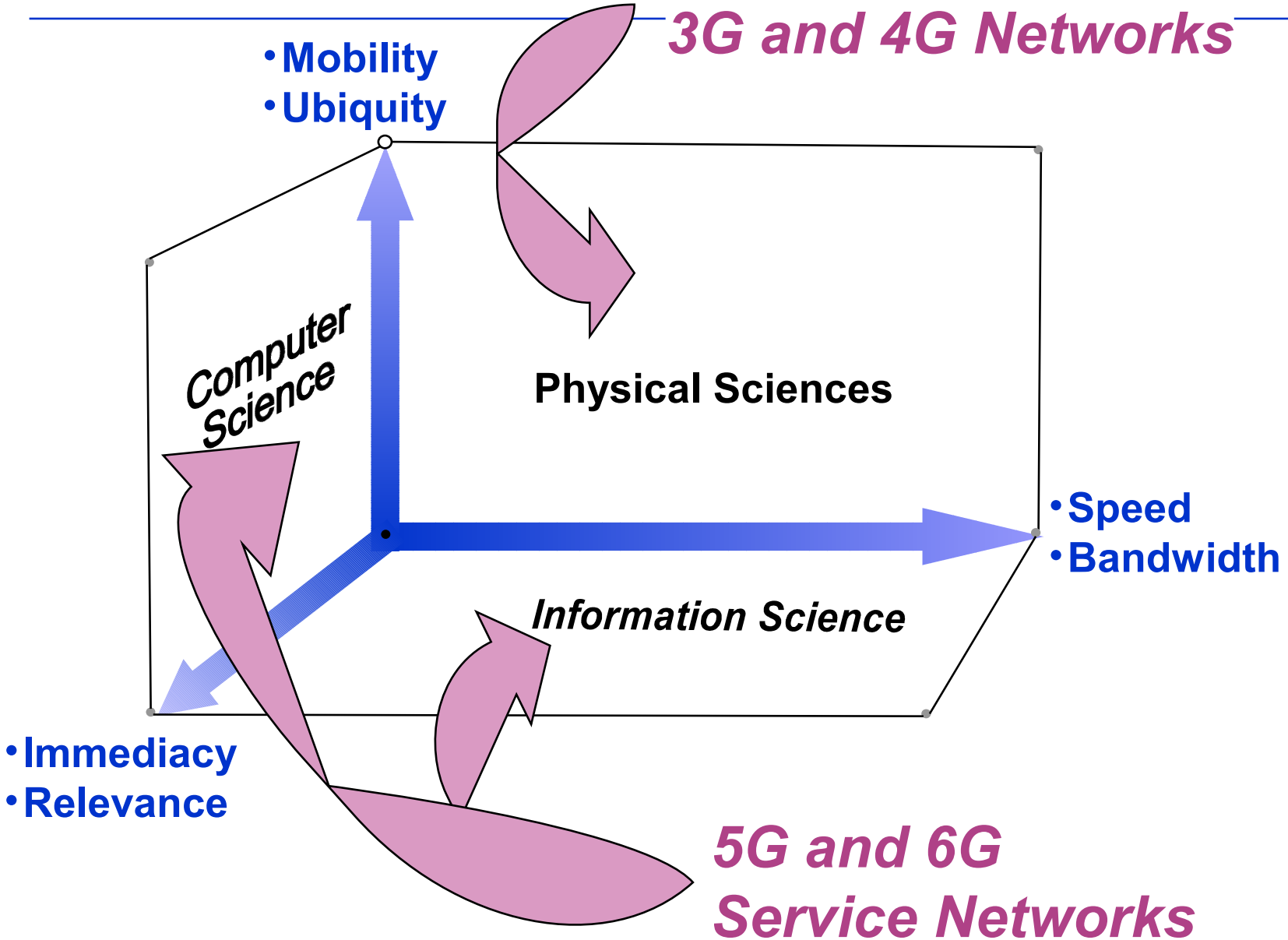
Future Directions



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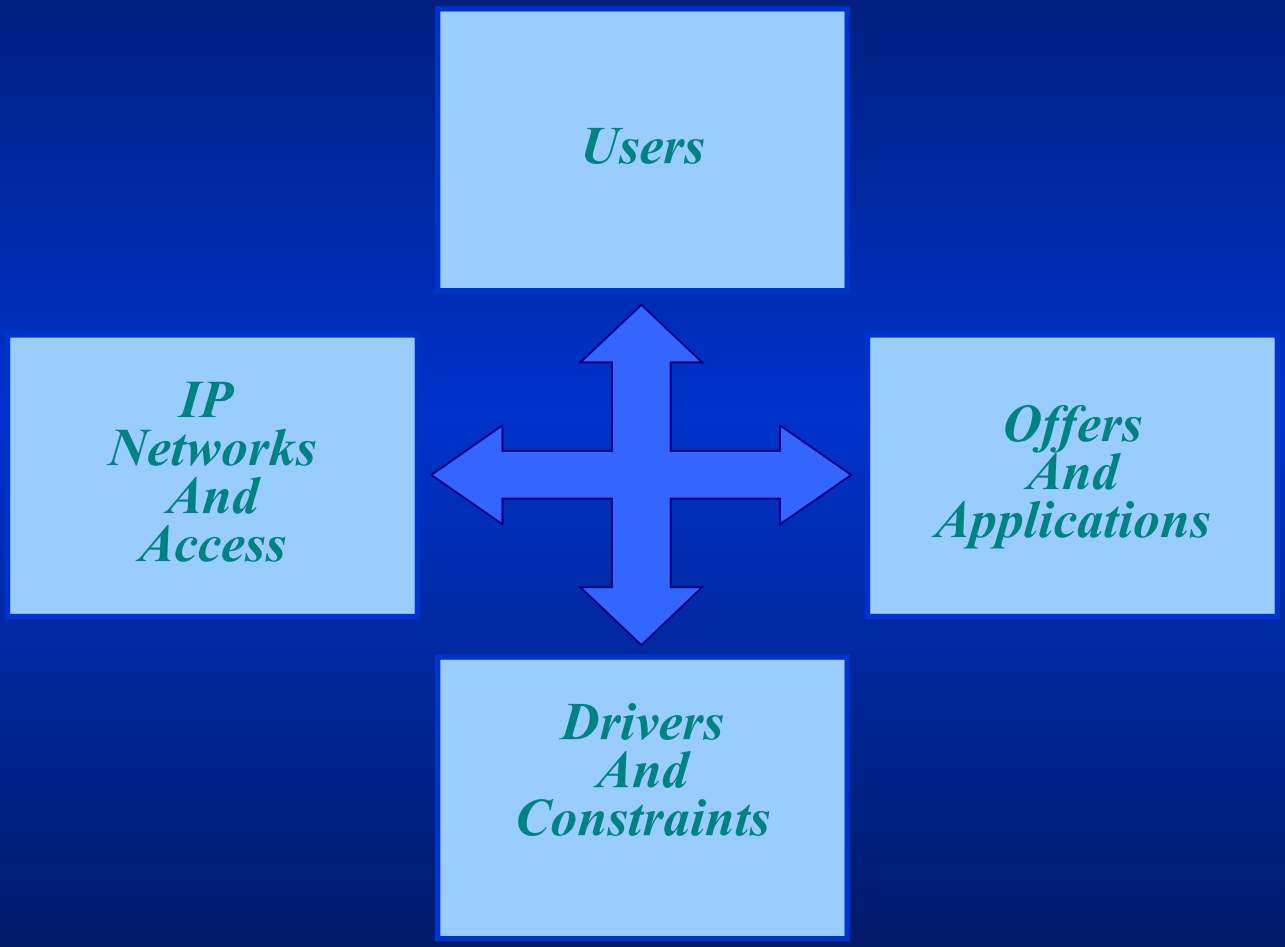
Future Directions

No Killer Application – Can we make Micro-services Payoff?



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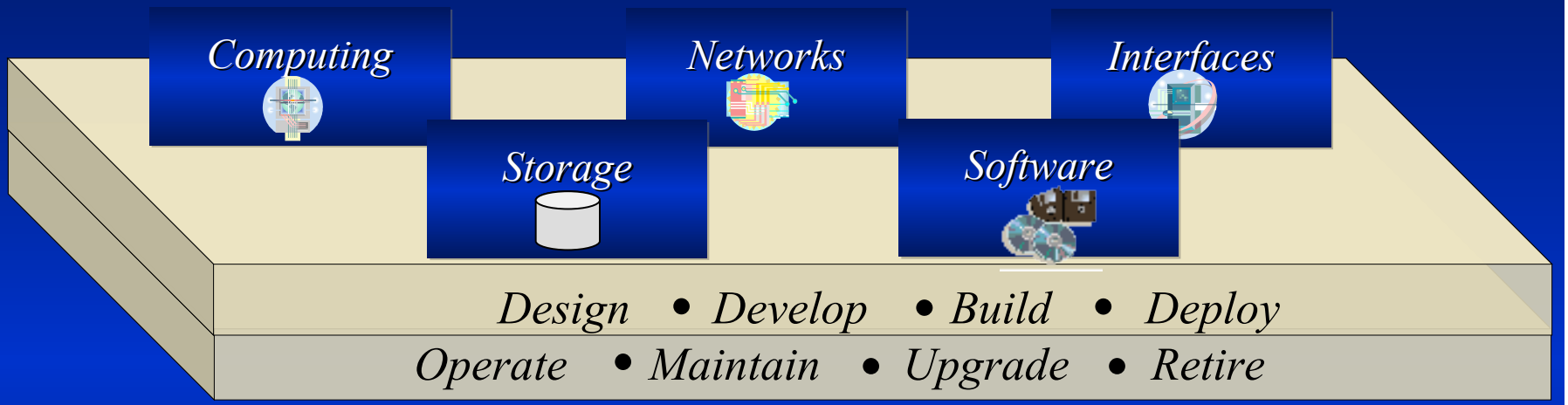
Future Directions

- **The Fabric for Network Services**



It's all about "convergence"

- *Messages*
- *Voice*
- *Documents*
- *Images*
- *Video*
- *Holograms*

Future Directions

- **Converged Services Challenges**
  - Data Explosion
  - Feature Interactions
  - Scalable QoS

Services & Interactions

gaming collaboration SMS voice personalization portals

Terminal Types

User Data

location subscriptions addresses biometrics preferences ??

Access Types

GSM WiFi DSL Cable UMTS WiMax

Standards & Protocols

3GPP OMA ISC ATIS SIP DIAMETER 3GPP2 AIN CDRs IMS

Physical Inventory

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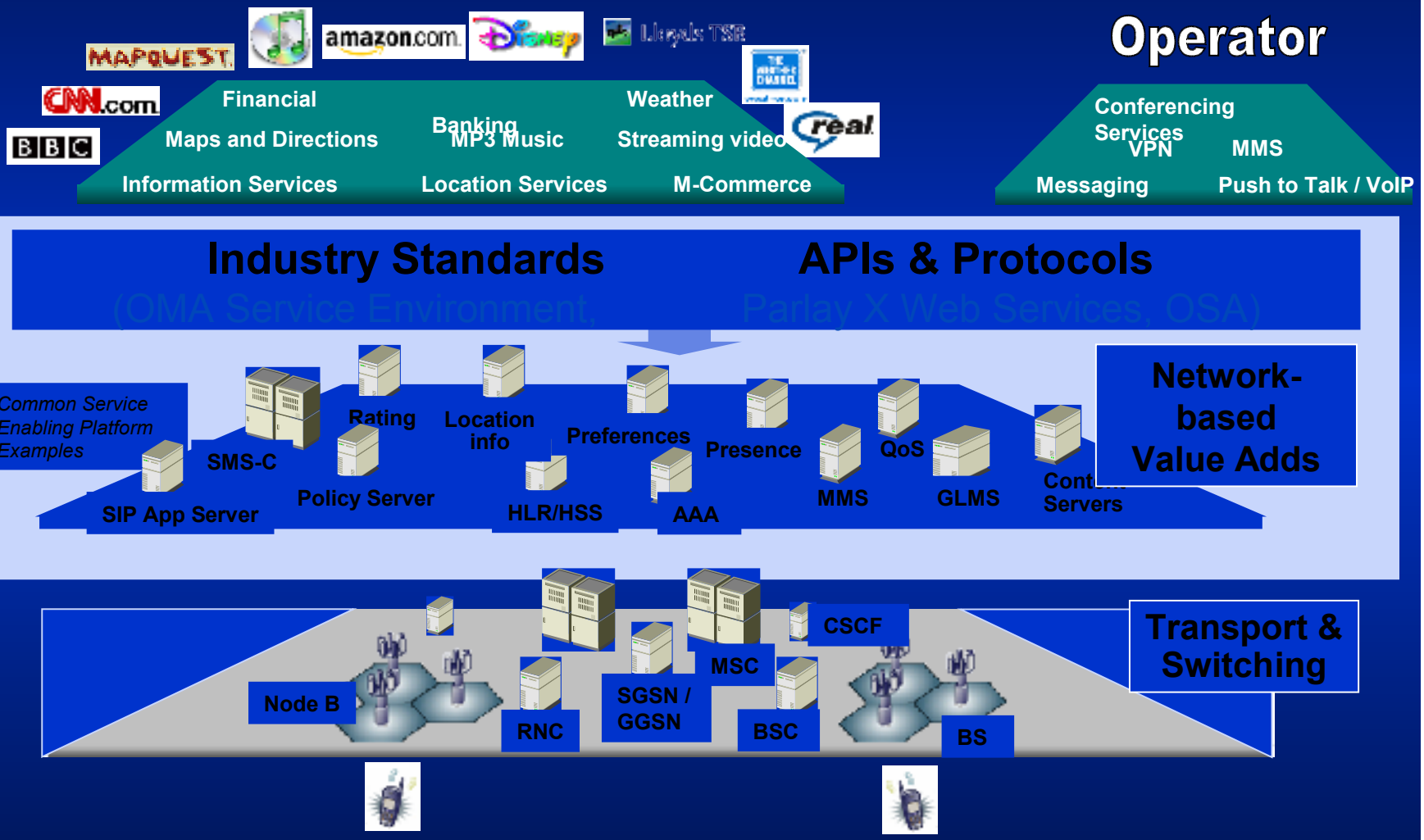
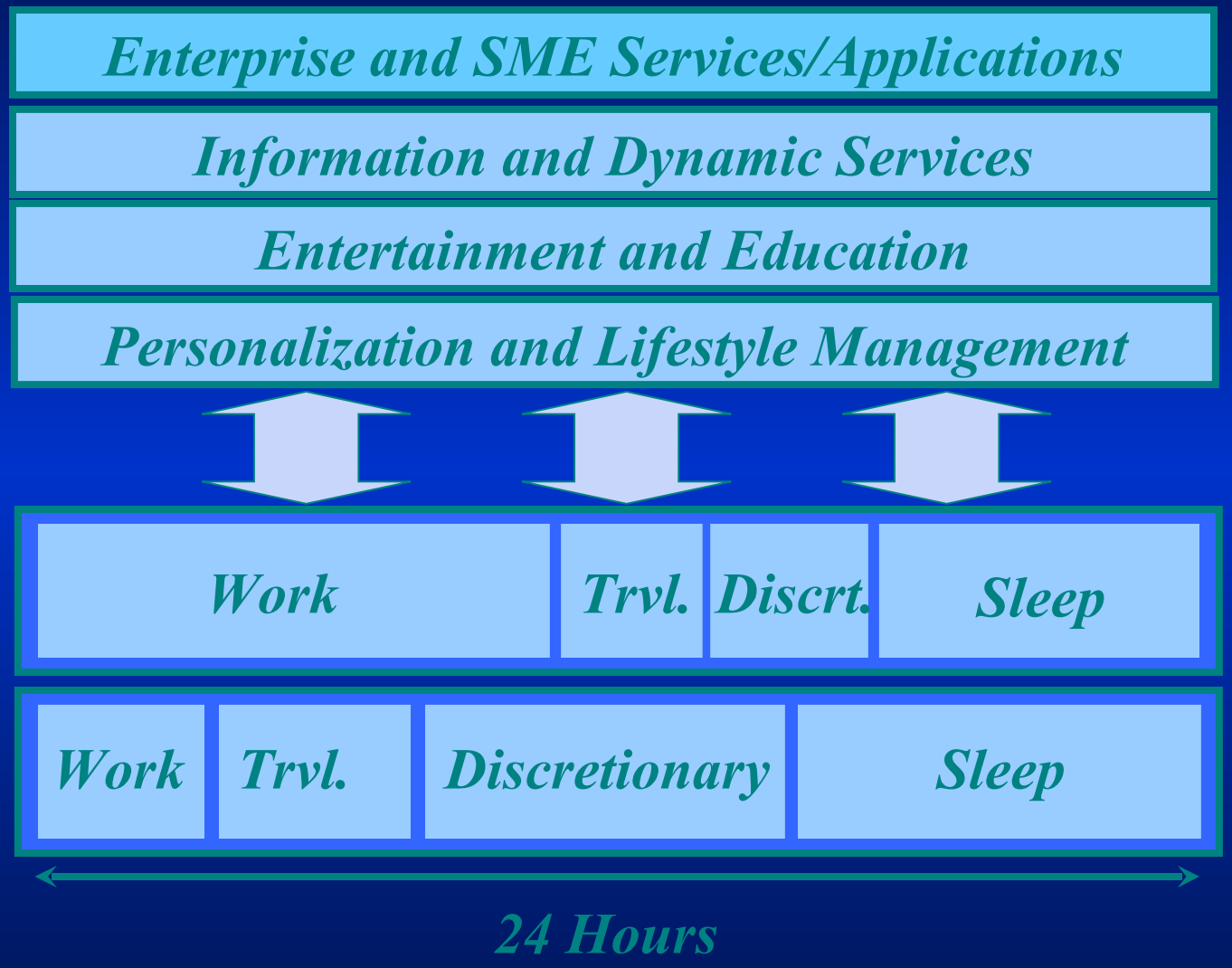
Future Directions

- **Emerging Services Framework**



Future Directions

The time we have is an invariant – how do we fill it?



Future Directions

At Work:

- Support for new business structure
- Support for new services
- Greater productivity

Future Directions

At Home:

Convenience
Comm unity
Personal ization
Enter tai nment

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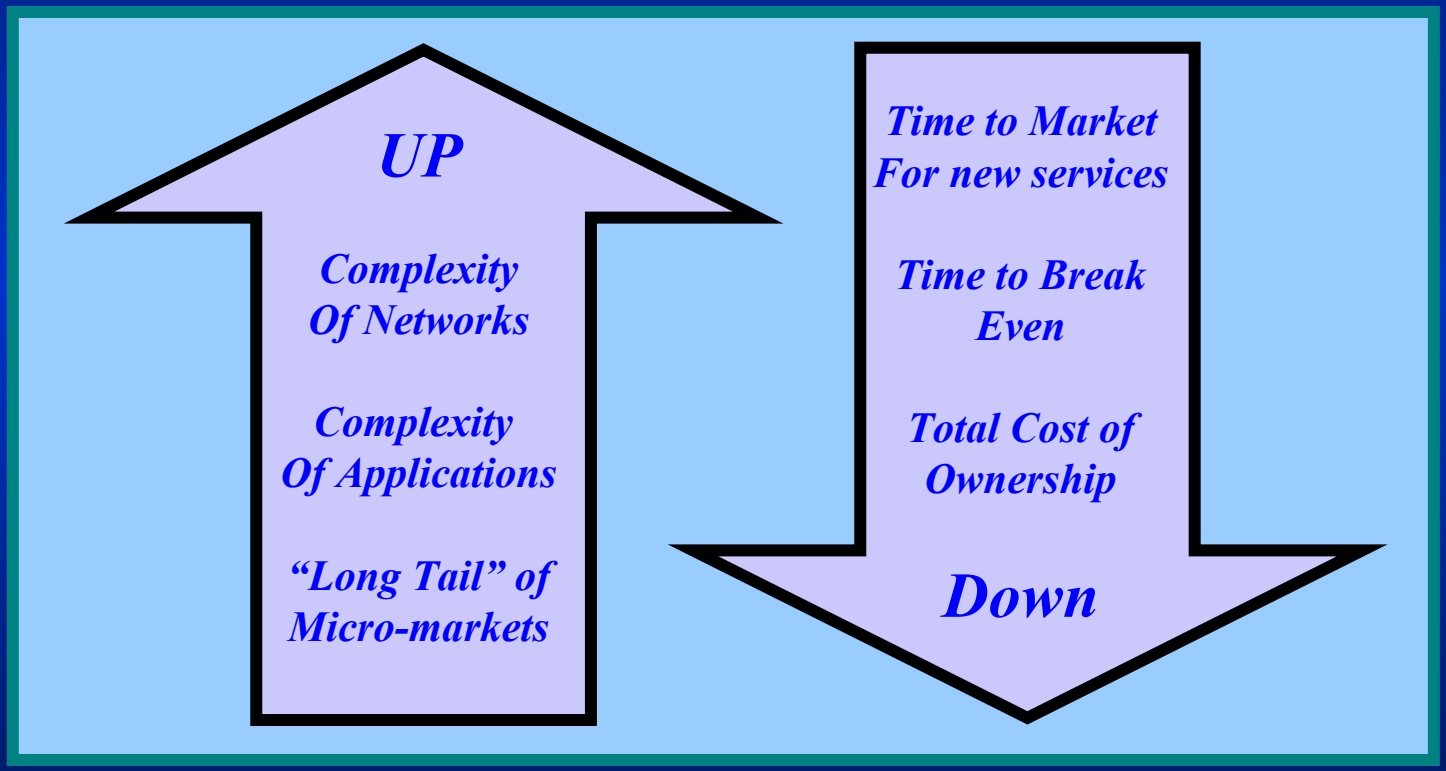
Future Directions

A New Moore's Law

"The Services Available to Consumers Will Double Every One to Two Years at The Same or Lower Cost"

Future Directions

IMS Middleware plays a fundamental role in Making the new "Moore's Law" a reality!



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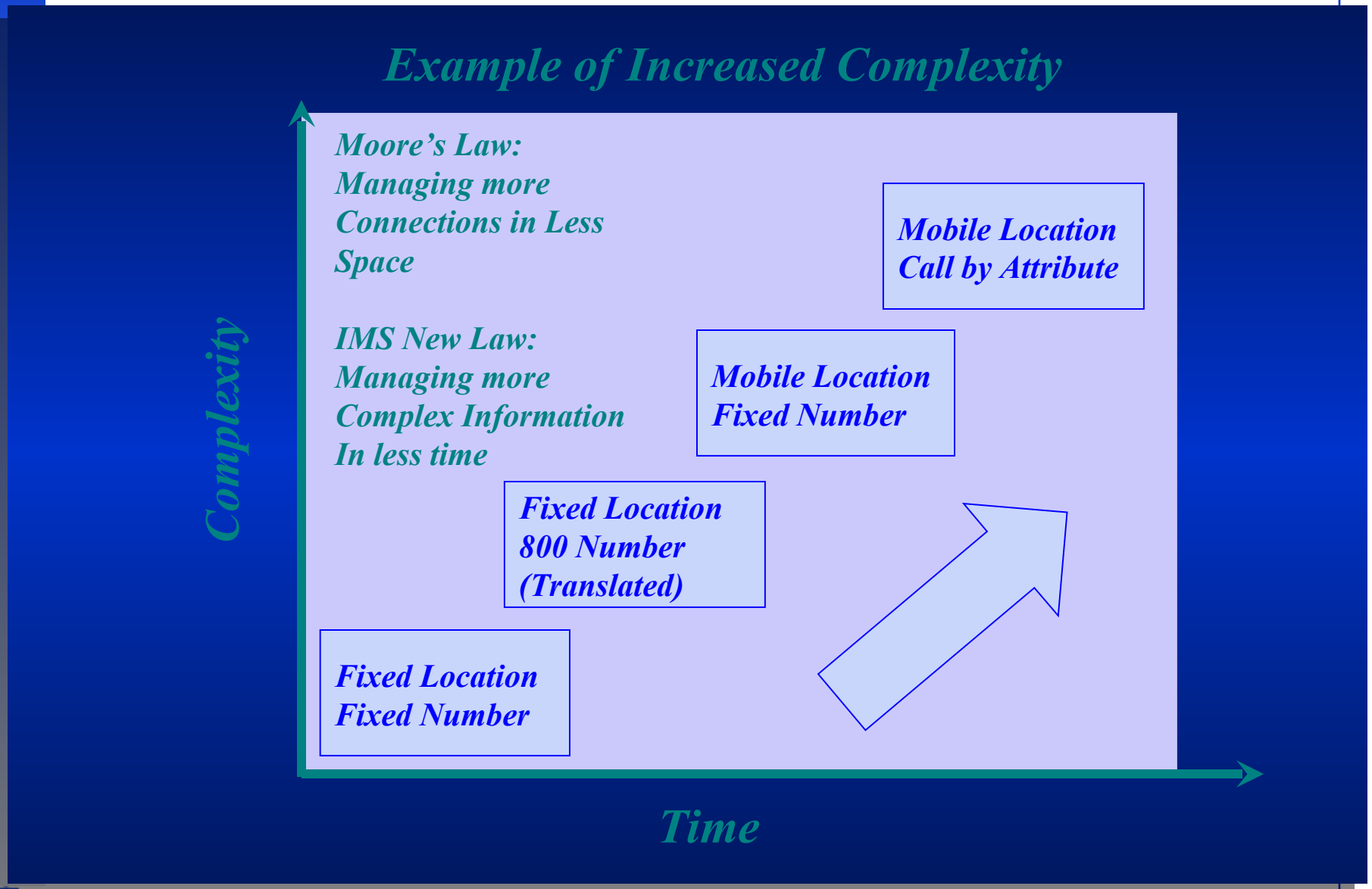
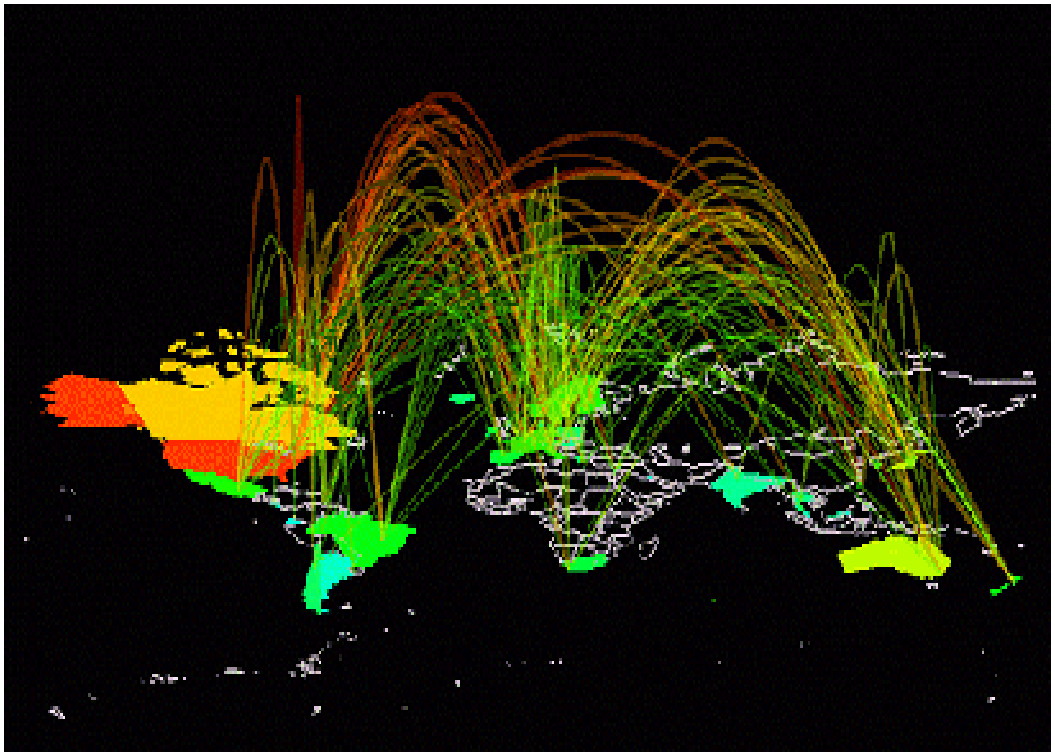
Future Directions





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