

Wireless Technology Transition

Mung Chiang

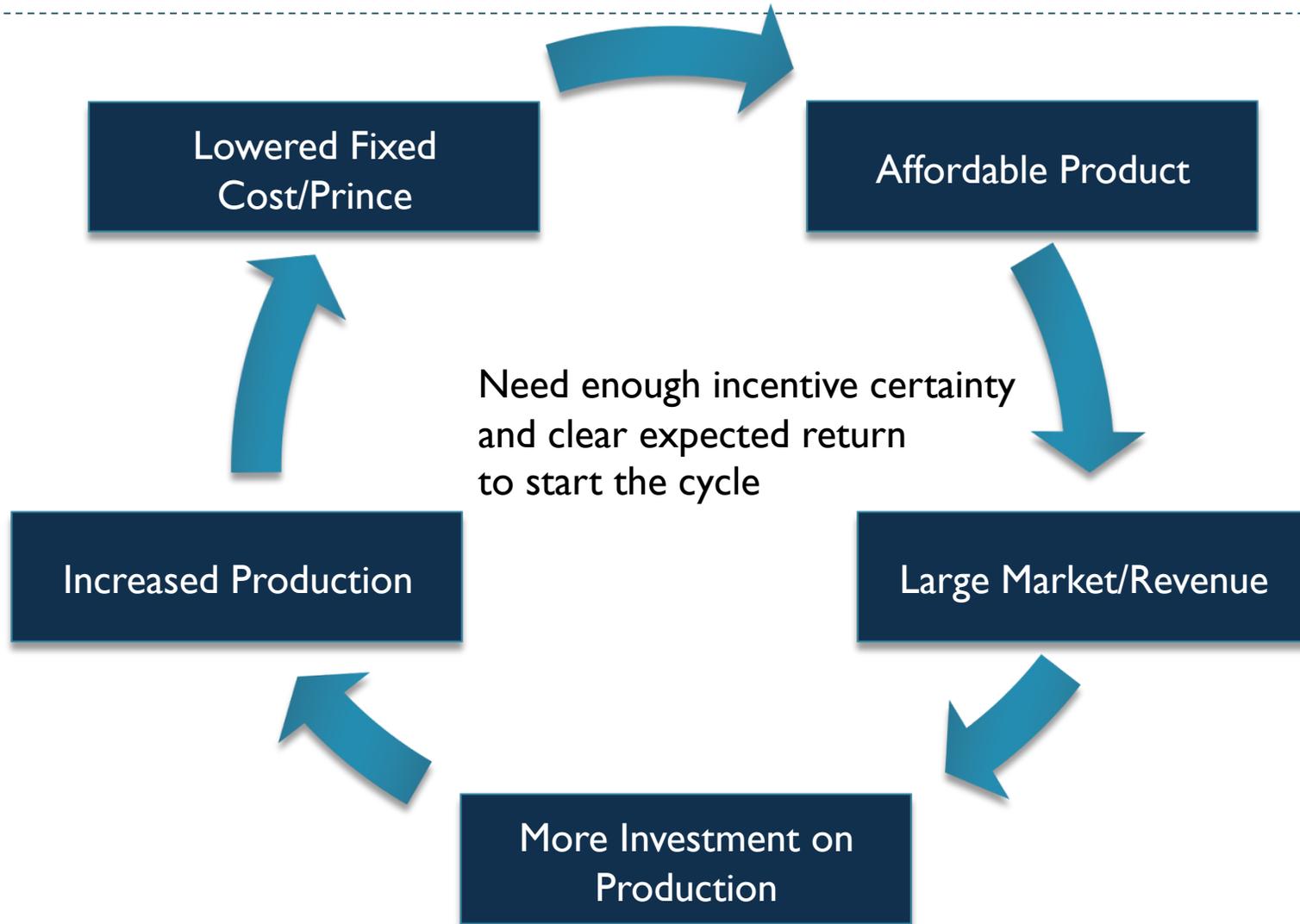
Princeton University EDGE Lab

Technology Transition > Technology

- ▶ **Phasing out** is even more challenging than **rolling out**
- ▶ Is the technology **backward compatible**?
- ▶ Is the benefit **incrementally deployable**?
- ▶ Is the cost **incentive compatible**?
 - ▶ Human cost
 - ▶ Equipment cost
 - ▶ Spectrum cost



From Harmonization to Scale



LTE Today

- ▶ LTE is great because:
 - ▶ Efficiency (b/s/Hz): Higher speed
 - ▶ Architecture (IP): Simpler and faster
 - ▶ Harmonization

- ▶ What about:
 - ▶ Fixed wireless: rural and urban dense
 - ▶ Copper: help with small cell backhaul

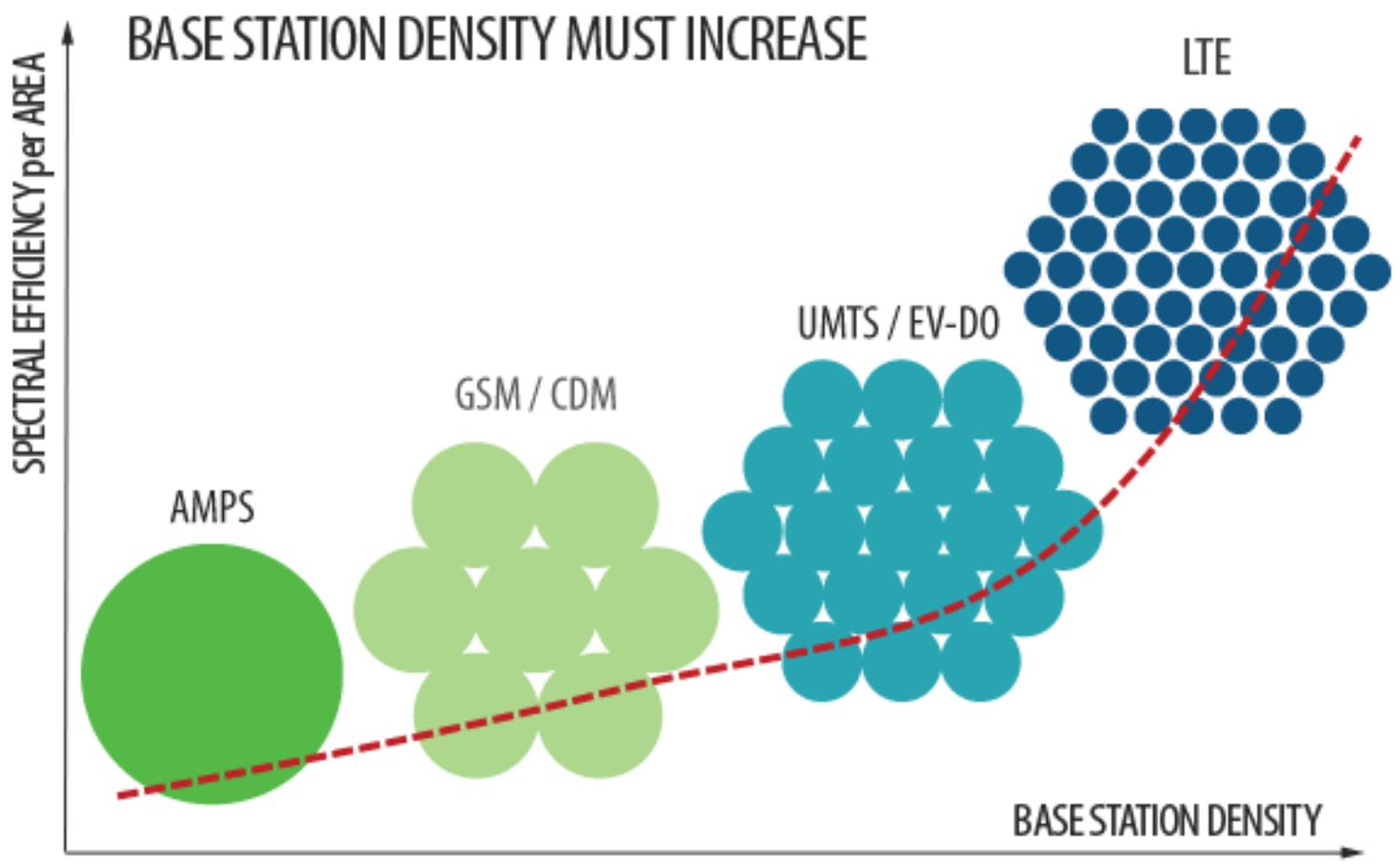


LTE Tomorrow

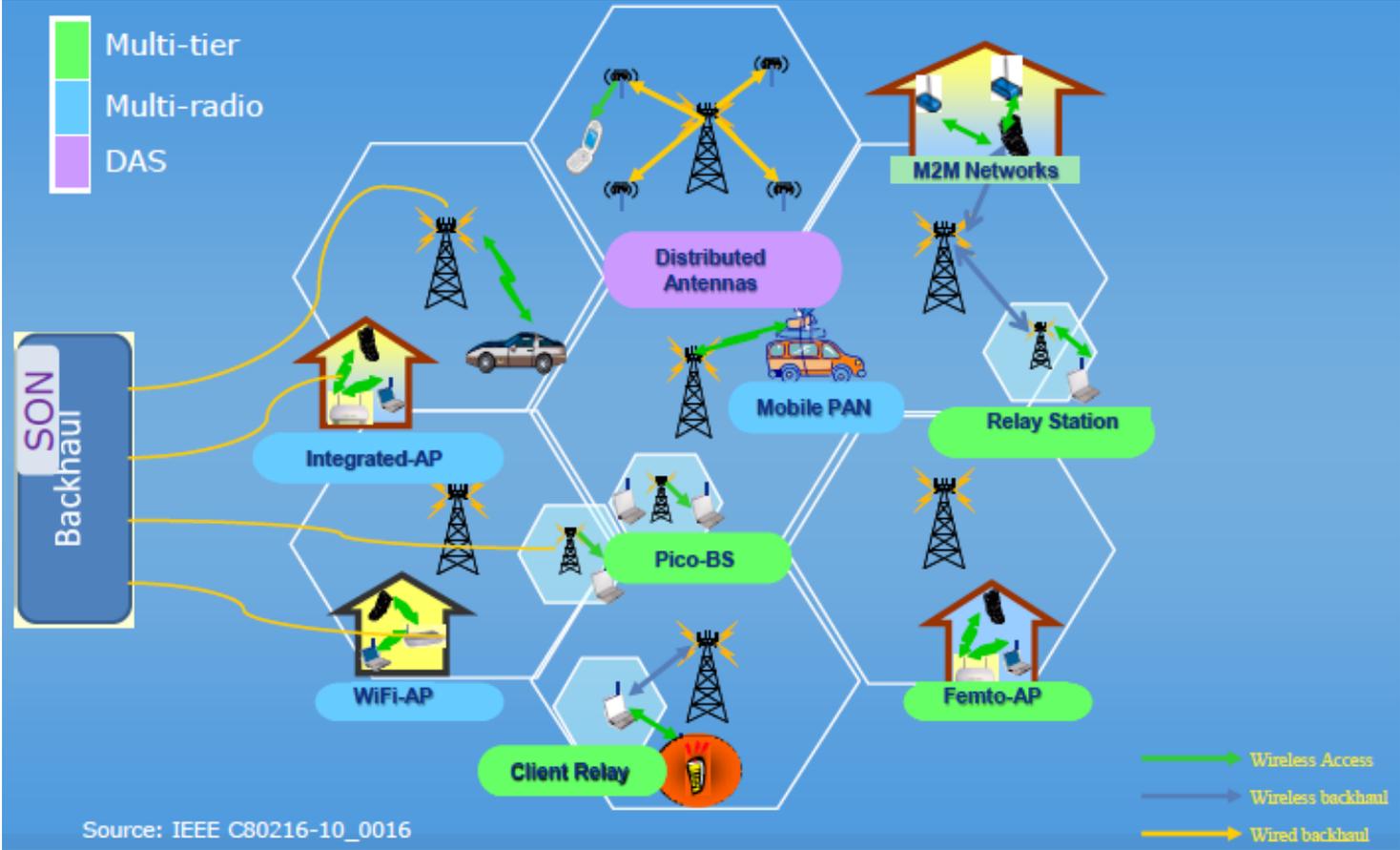
- ▶ Carrier aggregation in LTE Advanced, Voice over LTE...
- ▶ From capacity-focus to coverage-enhancement, SON...
- ▶ Supply-Demand match: Grand challenge of 1000X
- ▶ M2M opportunities and signaling optimization...
- ▶ Consumer QoE: From smart phones to smart data



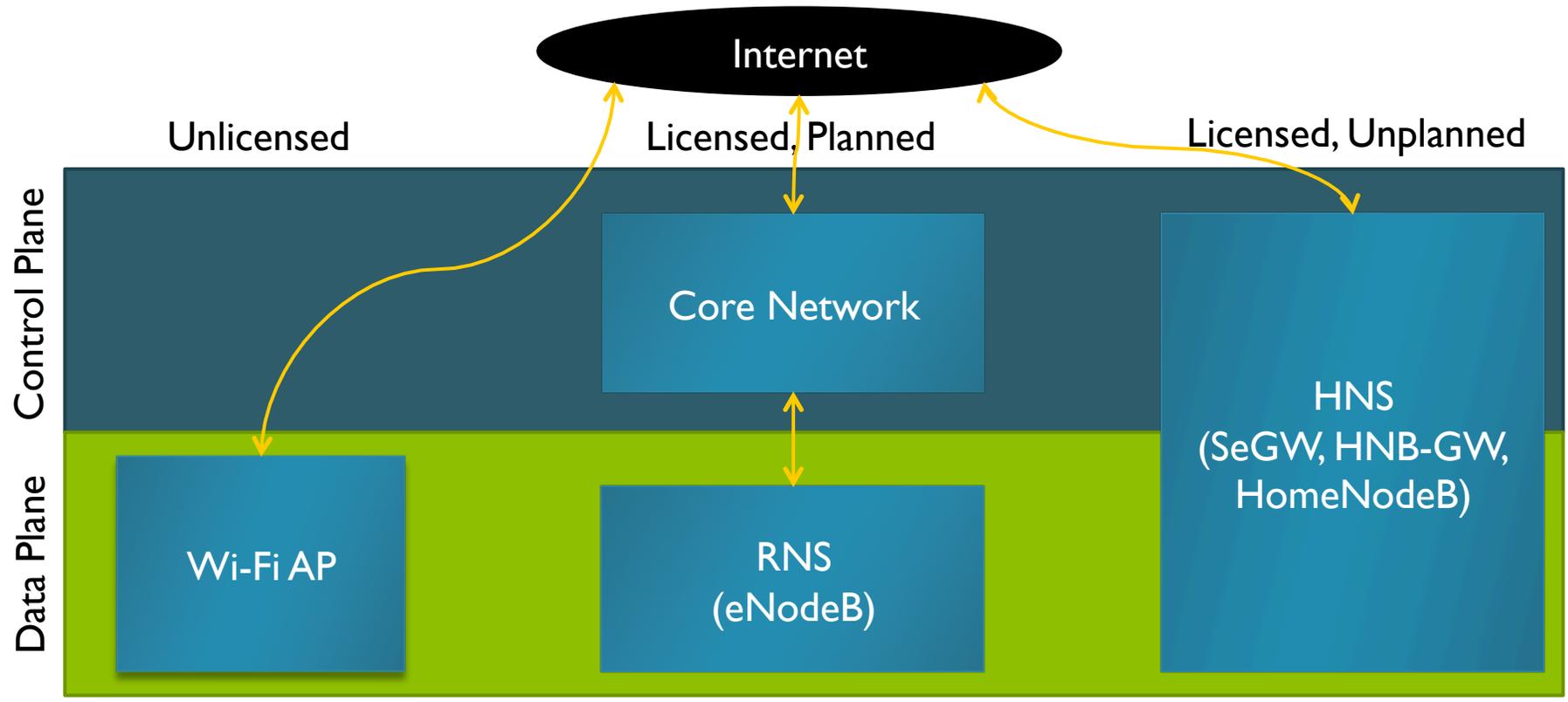
Supply: Smaller



Supply: Denser



Supply: "Wilder"

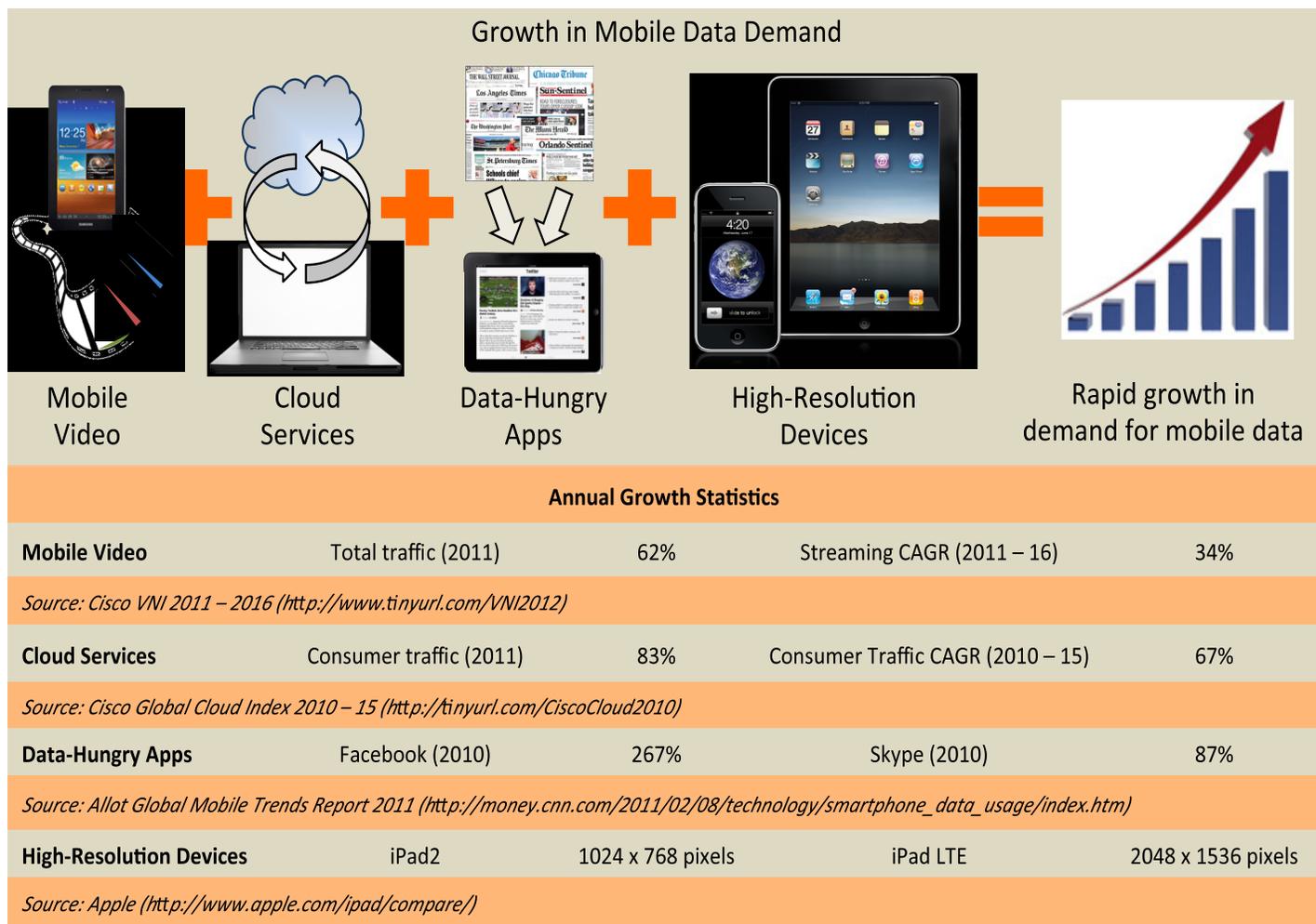


Demand: Smart Data-Pricing (SDP)

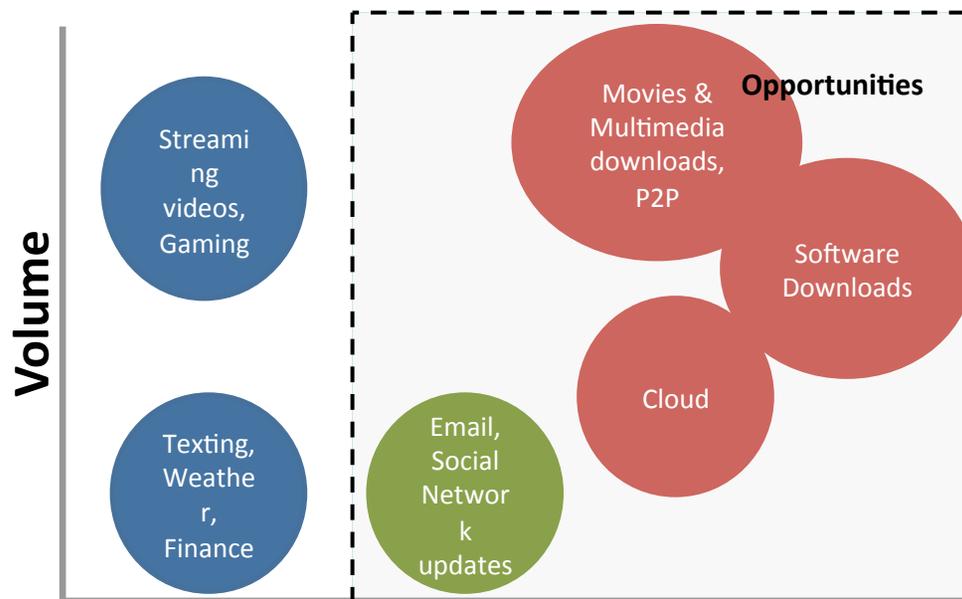
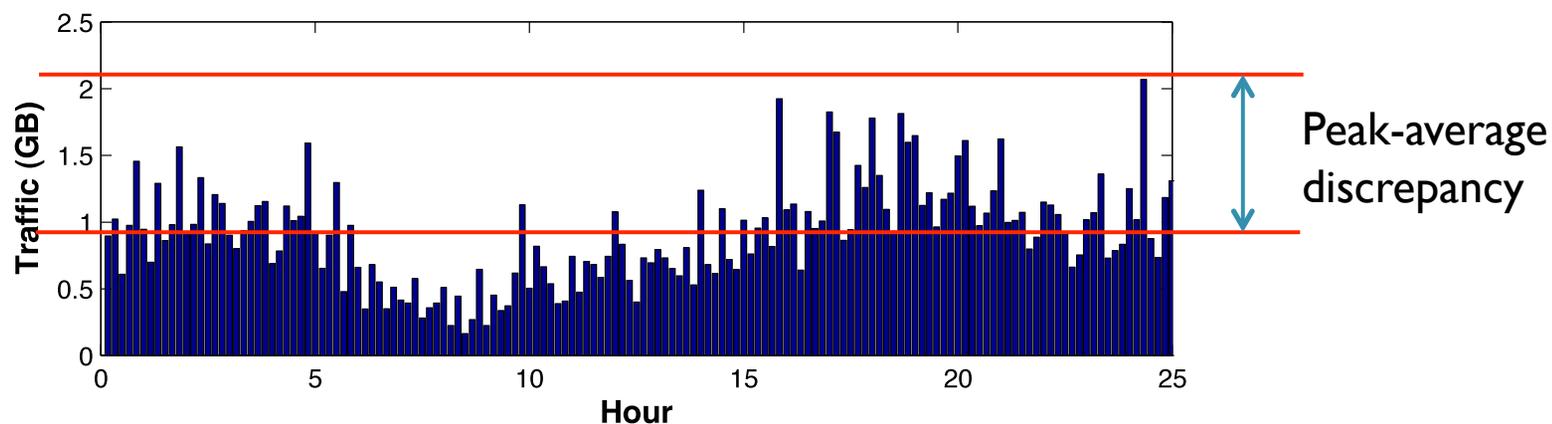
- ▶ Smarter sharing on “demand side”
- ▶ Application-layer, end-user-driven, tiered sharing & reuse
- ▶ “5G”:
 - ▶ user experience
 - ▶ personalization
 - ▶ app economics
 - ▶ pipe-content divide
- ▶ MTA – Princeton trial in rural Alaska



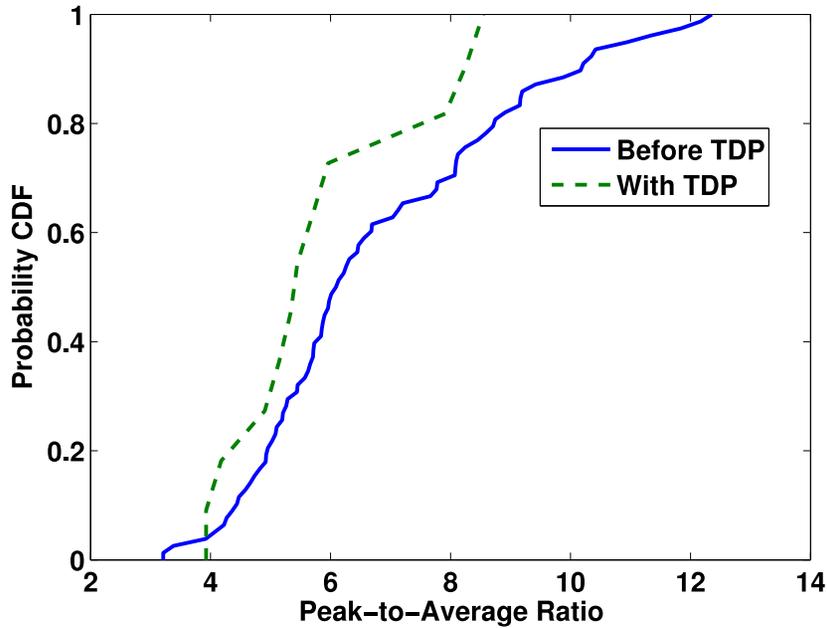
Why: Jobs' Inequality of Capacity



Waste and Opportunity in “Time”

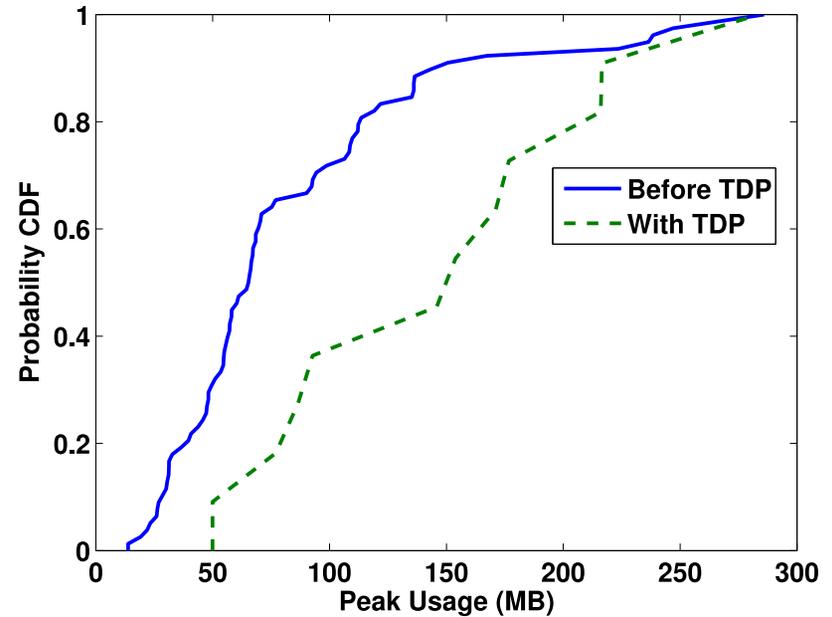


Time Shifting: Princeton Trial

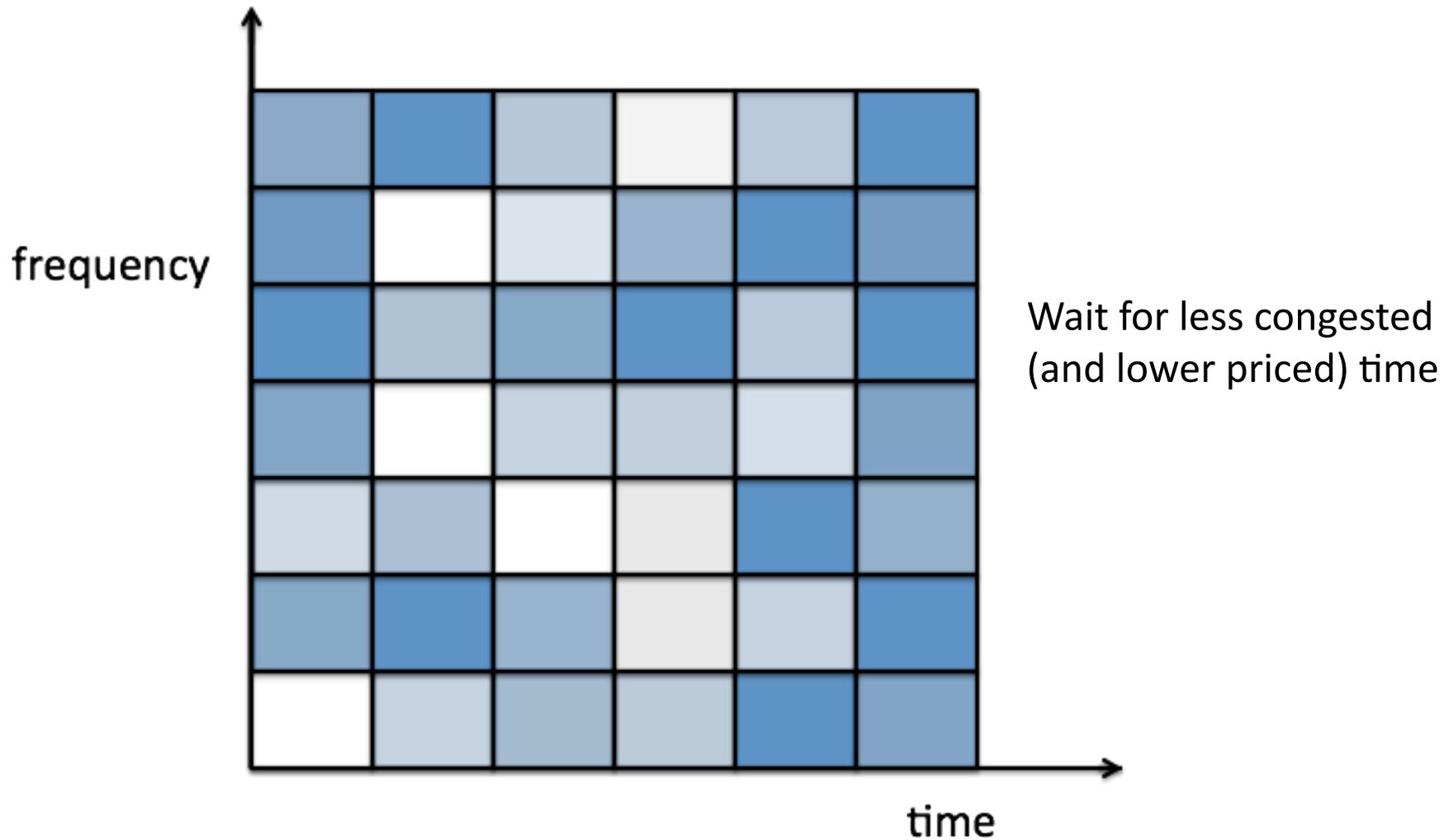


Maximum PAR decreases by 30%

Overall usage increases 130%



What's More: "Flashy" Whitespace

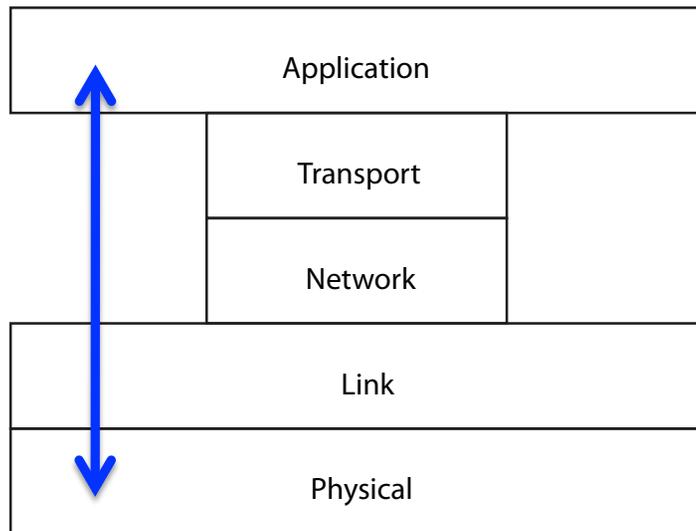


Paradigm Shift

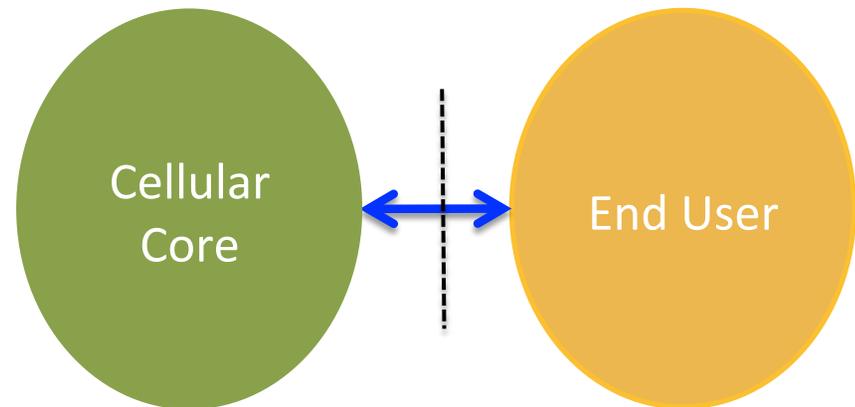
- ▶ Stop (just) counting bytes and start living with QoE
 - ▶ Recognize and leverage heterogeneity of apps and networks
- ▶ Win – Win – Win
 - ▶ Consumers: more choices and lower \$/GB
 - ▶ Carriers: lower cost and higher revenue
 - ▶ Content/App providers: more engaged eyeballs



Where to Innovate?



Smart sharing in APP + PHY



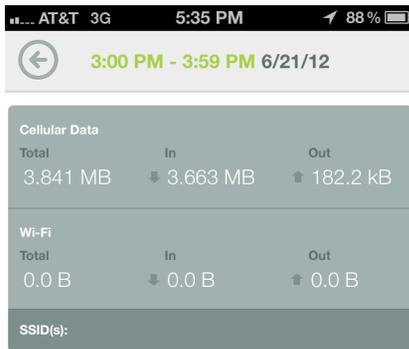
Mobile management from the edge



By the Users, Of the Users, For the Users



DataWiz App



Thank you

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