



## A future of Abundance

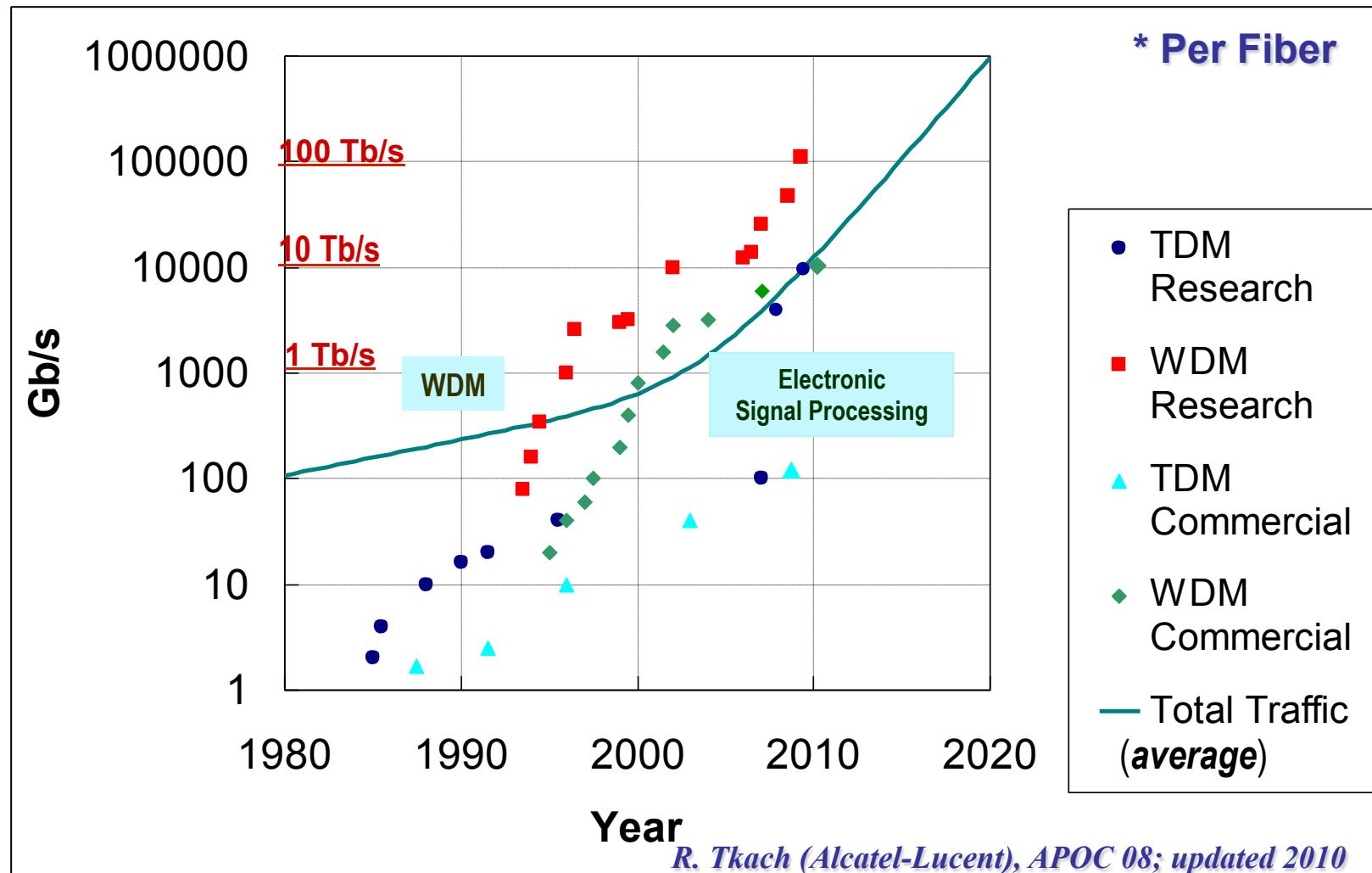
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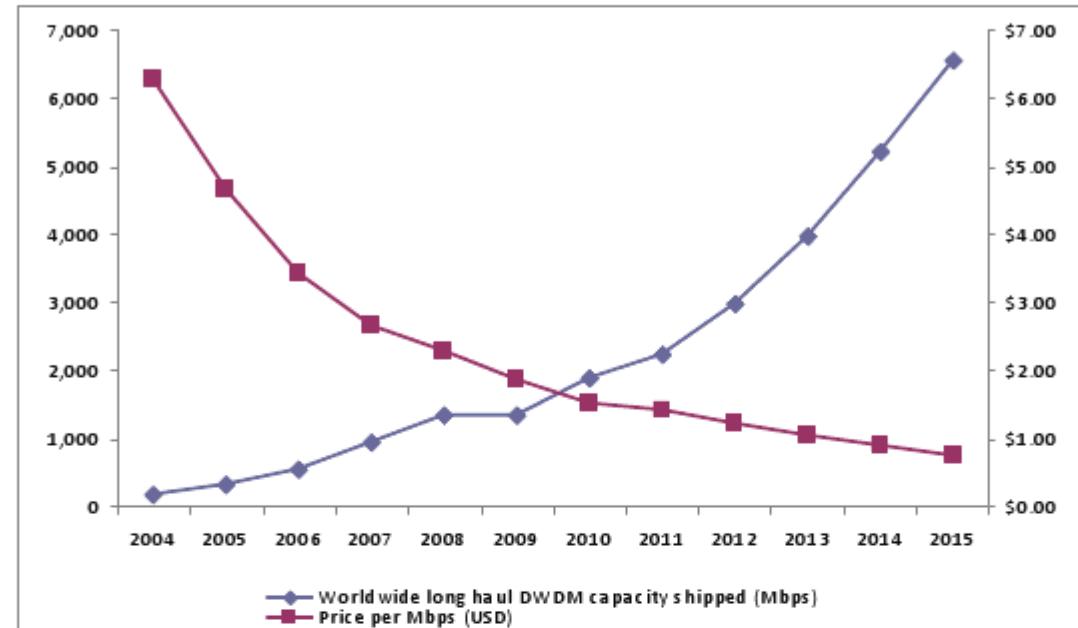
# Progress of Optical Fiber Communications

## System Capacity\* and Network Traffic



Over a period of 25 years, the system capacity has increased by almost 5 orders of magnitude!

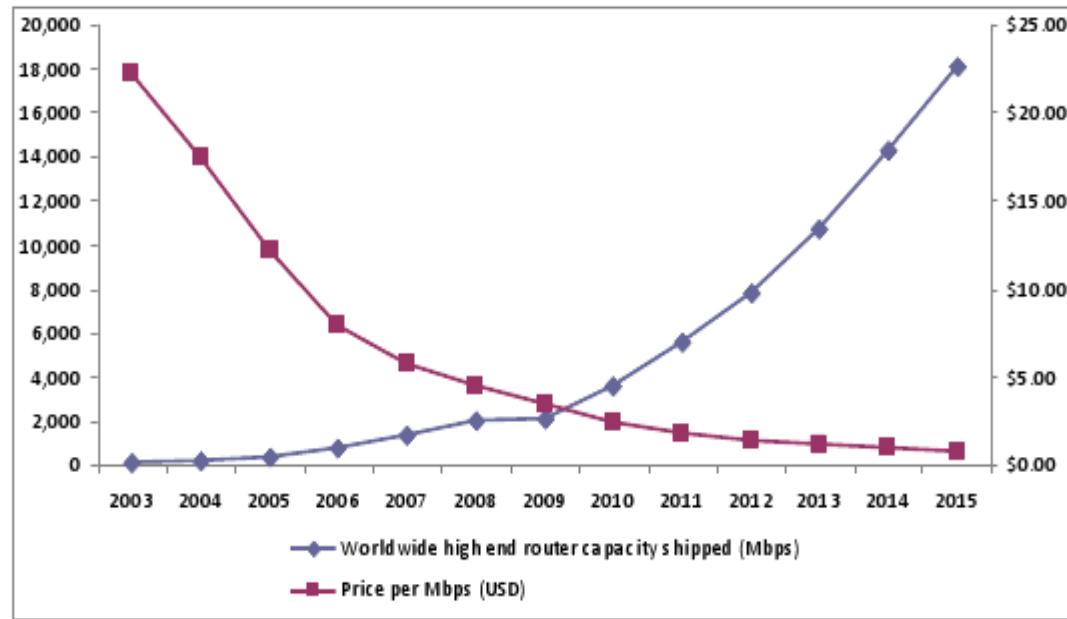
## Large increases in optical capacity at flat cost



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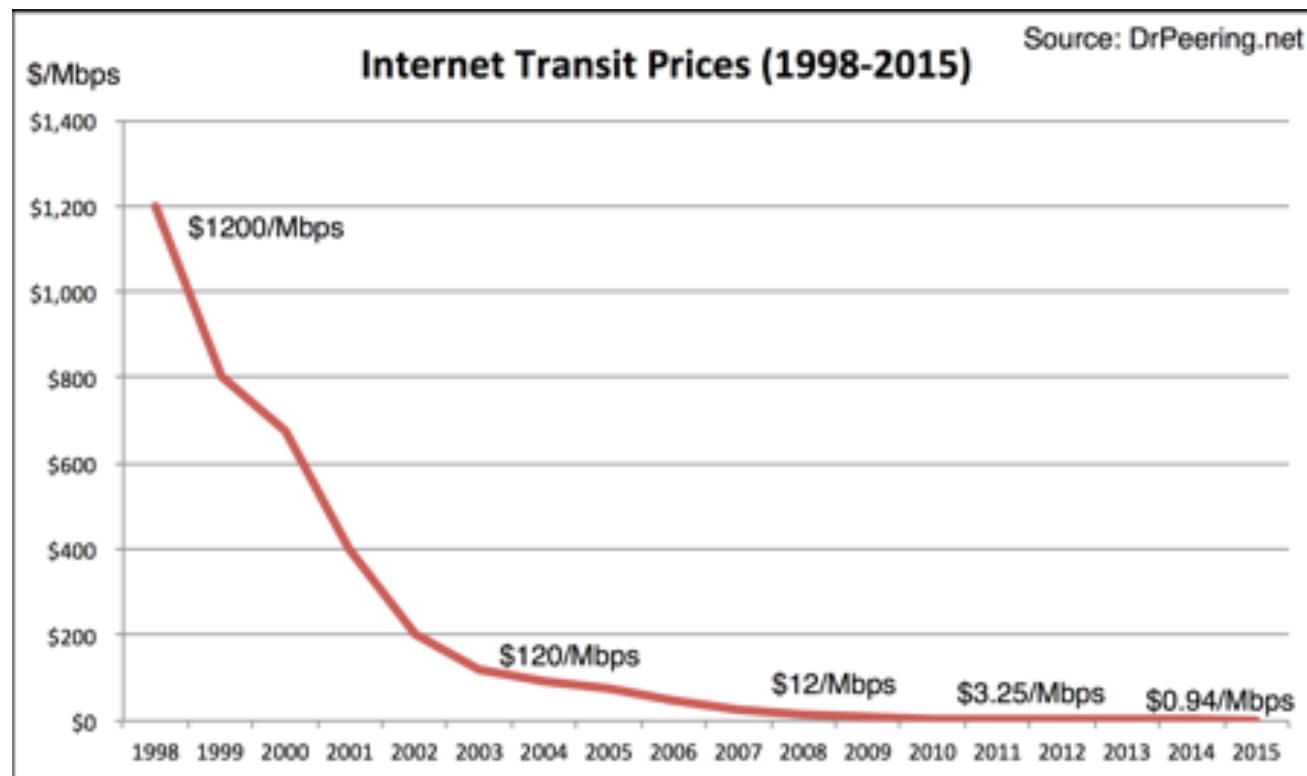
Source: Dell'Oro data,<sup>19</sup> WIK calculations

## Large increases in routing capacity at flat cost

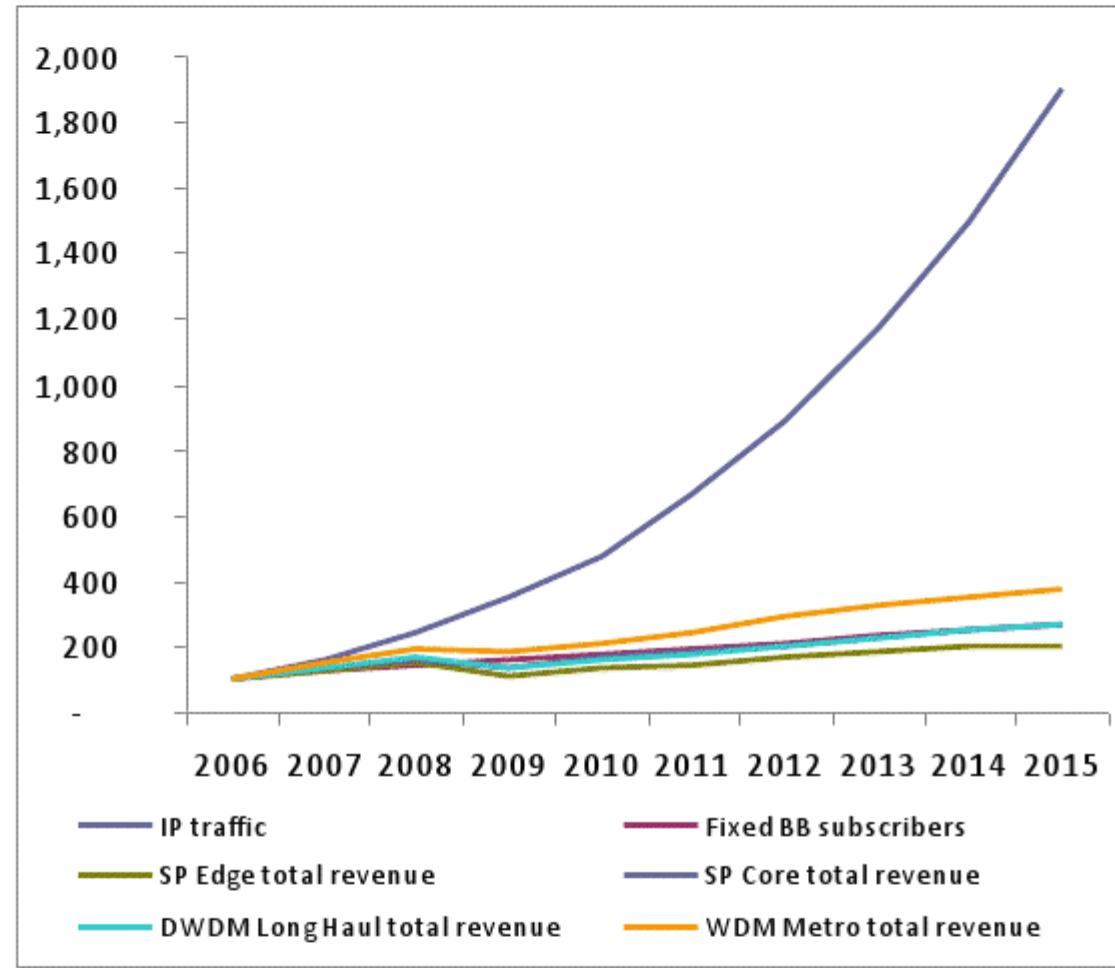


Source: Dell'Oro data,<sup>18</sup> WIK calculations

With a resulting decline in Internet Transit pricing



## Costs and revenues are flat despite significant traffic growth



## Wireless can follow this curve as well

- **Cellular access is not following the wireline curve despite progress**
  - We now are moving to OFDMA based technologies that allow much higher capacity using wider swathes of spectrum
  - Beamforming and other active antenna technologies are improving spectral efficiency
  - Small cells will allow much faster growth in capacity than adding spectrum in macrocells
    - the future of cellular will look like wifi today
- **But spectrum continues to be a major constraint**
  - This is odd, because most spectrum is unutilized – we have an allocation problem
  - The FCC and Government cannot clear spectrum as in the old days – a new paradigm is required
  - Shared spectrum technologies will allow us to transcend this limit
  - Newer more band agile radios will empower new types spectrum use and industry will move in this direction if new vistas of spectrum are accessible with it
  - We can get wireless back on the wireline curve if we can opportunistically share much more spectrum which is possible in smaller cells

## **“Potterville”**

- **An alternate view of the future is possible**
- **Aggressive usage based pricing has the potential to retard bandwidth growth significantly**
- **By rationing access to capacity, carriers may move Internet transport to a much more static bandwidth expansion**
- **It's easier to not have to innovate and invest, if competition doesn't force that investment**