Yttibrium

Cool Solutions for a Warming World

Past, Present, and the Bleak Future

STORAGE

Looking back 10 Years

- SAS was in it’s hey-day, FC drives ruled, and the SAS protocol was the answer to all evils
- Datasets fit into scale-up architectures
- NFS was starting to die

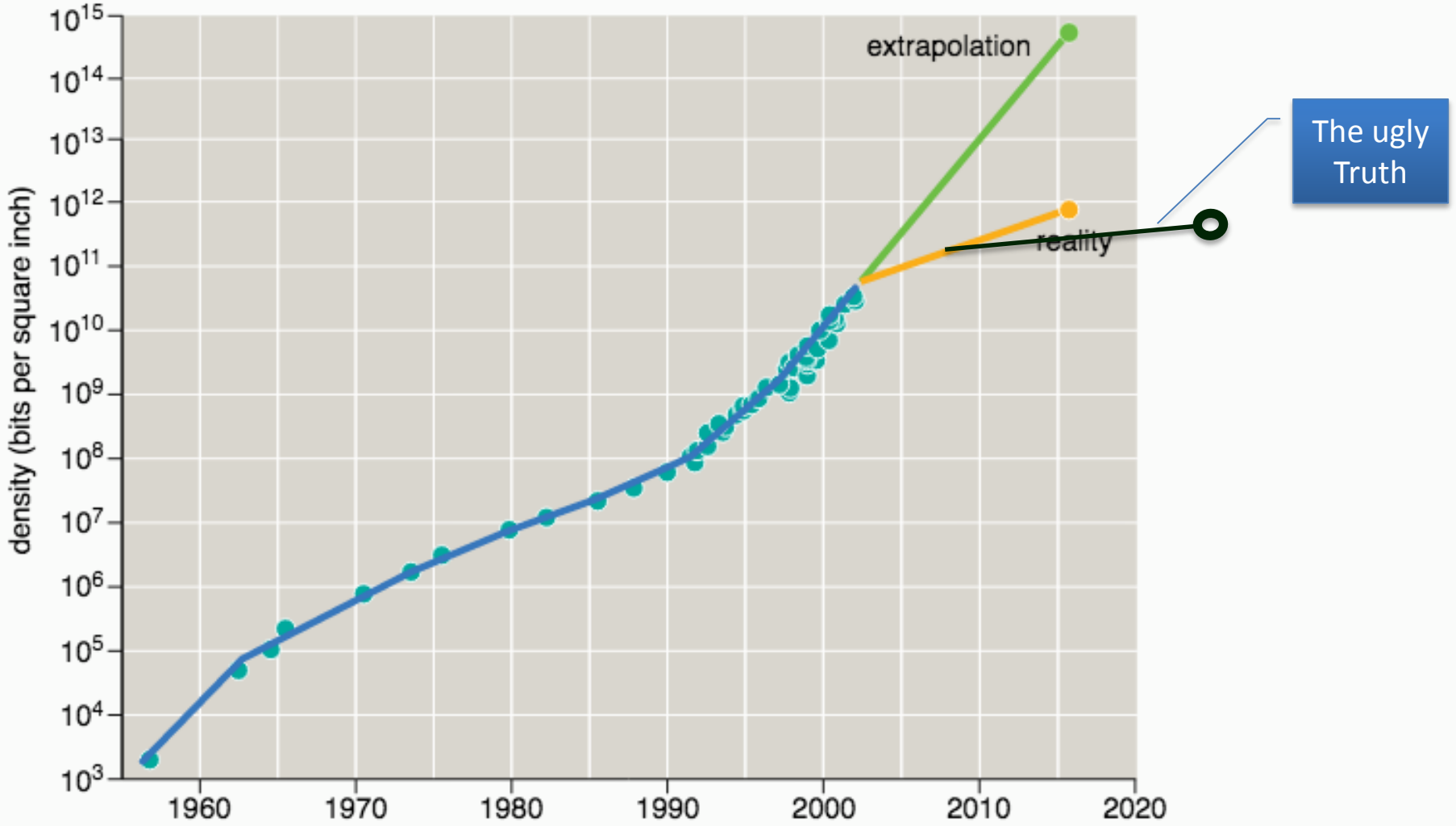
Looking back 5 Years

- JBOD became cool, and physical disaggregation was the name of the game
- Hadoop and other data-lakes were still in their ‘puddle’ phase with a few outliers leading the charge
- RAID failed us and EC was in it’s infancy

State of Storage Today

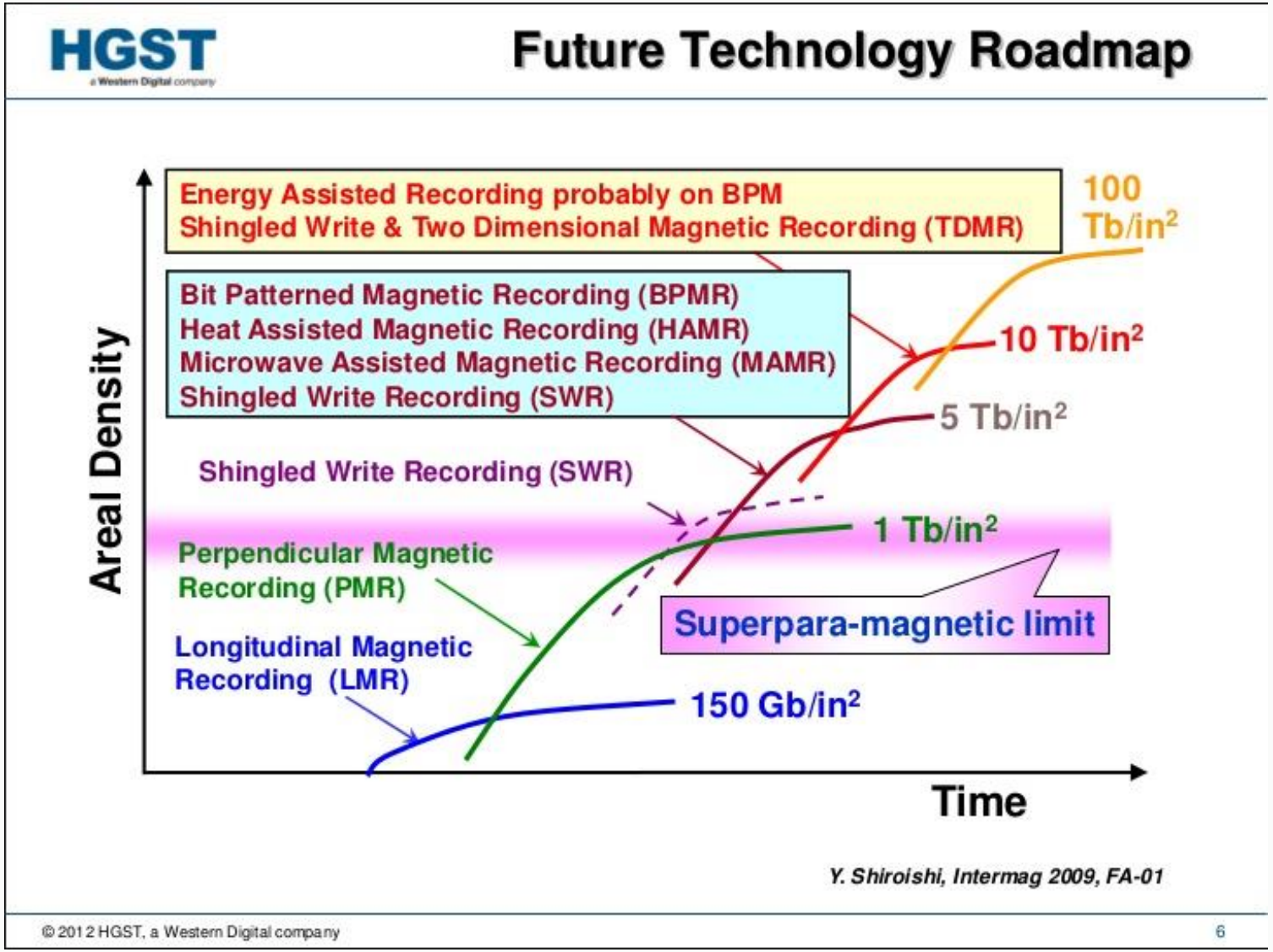
- Software integration into the device is the trend, FTL, Rebuild Assist, ISE etc.
  - Hyper-scalers are bucking the trend, wanting dumber endpoints and the CPU to do all the work
- Erasure Coding grows up and goes 3-D
- SMART was dumbed down so DHM is to be our salvation, but T10/13 are too slow
- Arial density is reaching a maximum

We Hit up Against the Laws of Physics



Source: Bit-player.org plus additions

The Optimists Opinion, All based on SMR



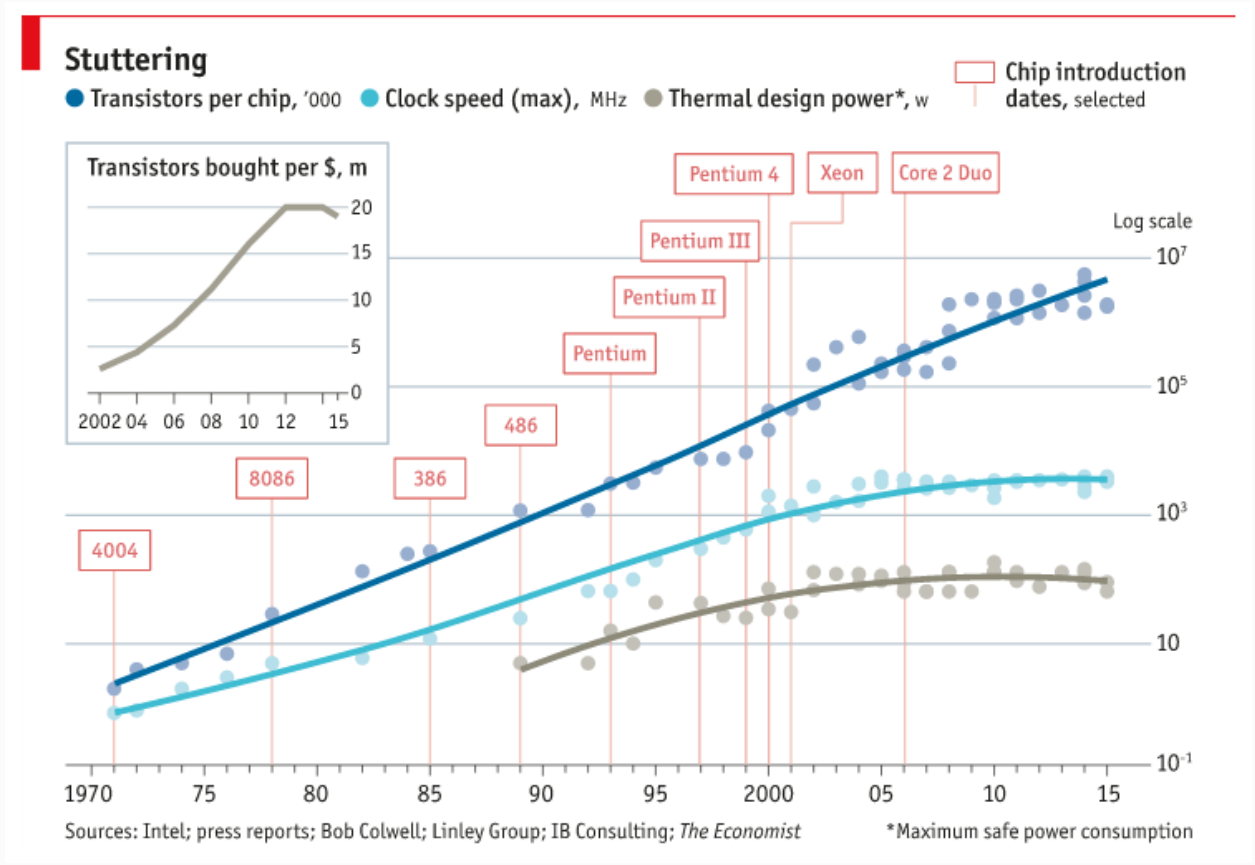
Bulk Tier, What is Coming to Help?

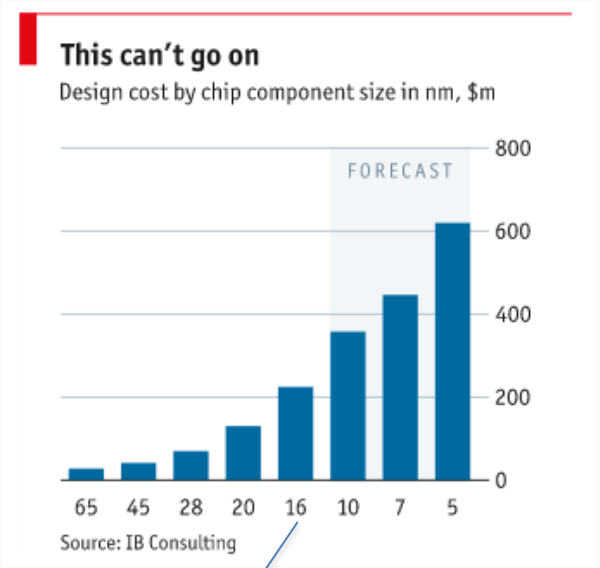
- TPI, BPT and total inch^2 games to squeeze bits in
- He, SMR, TDMR, HAMR, BPM and other esoteric technologies are all adding cost
- RV becomes the biggest issue
- ATI and the need to keep committed data safe after a write
- Noise became a real problem
  - https://www.youtube.com/watch?v=tDacjrSCeq4

Hot Tier

- # junctions per sq mm
- Thermals & die stacking already an issue
- Disaggregation via NVMe-F vs. more lanes on the CPU complex
  - Other methods for making the CPU a loaner..
    - Intel: Rack Scale Architecture, Inspur: Scorpio, OCP: OpenRackV3..

All Resources Tapped Out





A Junction now is the diameter of 50 electrons

Cold Tier

- Tape has legs, but suffers badly in the efficient DC environment
  - RIP LTO, OpenStandards we will miss you, hello Neodymium
- BluRay is up and coming fast
  - New densities make it attractive, better throughput, great random reads
  - TTFB vs. cost and longevity, BluRay cannot be ignored
- Cold Flash has a niche play (checkpointing for instance) and could see a revival into many applications

The Envelope

- Thermal and RH implications as we push for higher efficiency in the DC
- Cloud-Scale economics for the rest of us
  - Fractional pennies per GB for cold data
  - Need for auditability and secure sharing of datasets
- Higher density is the enemy
  - Air flow impedance causes a log-growth in power overhead
  - DC floor costs are dropping drastically
    - Early POD designs did not include the infra components

Storage History and Future

- Call to action:
  - Do not let the Hyperscale accounts dominate the conversation, open up workload profiles and use-cases to the device manufactures
  - Start classification and data value assessments, put the data into a tiered storage architecture to reduce long-term costs, and deliver usable performance on demand
  - Look for value-added software to come from startups who got sick of the status quo and went out on their own
    - get an in before they are bought up..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Thank You