

If Elon Musk Designed a Warehouse – How Tesla-like Technology Changes the Game

Presented by:

Jerome Dubois, Co-Founder



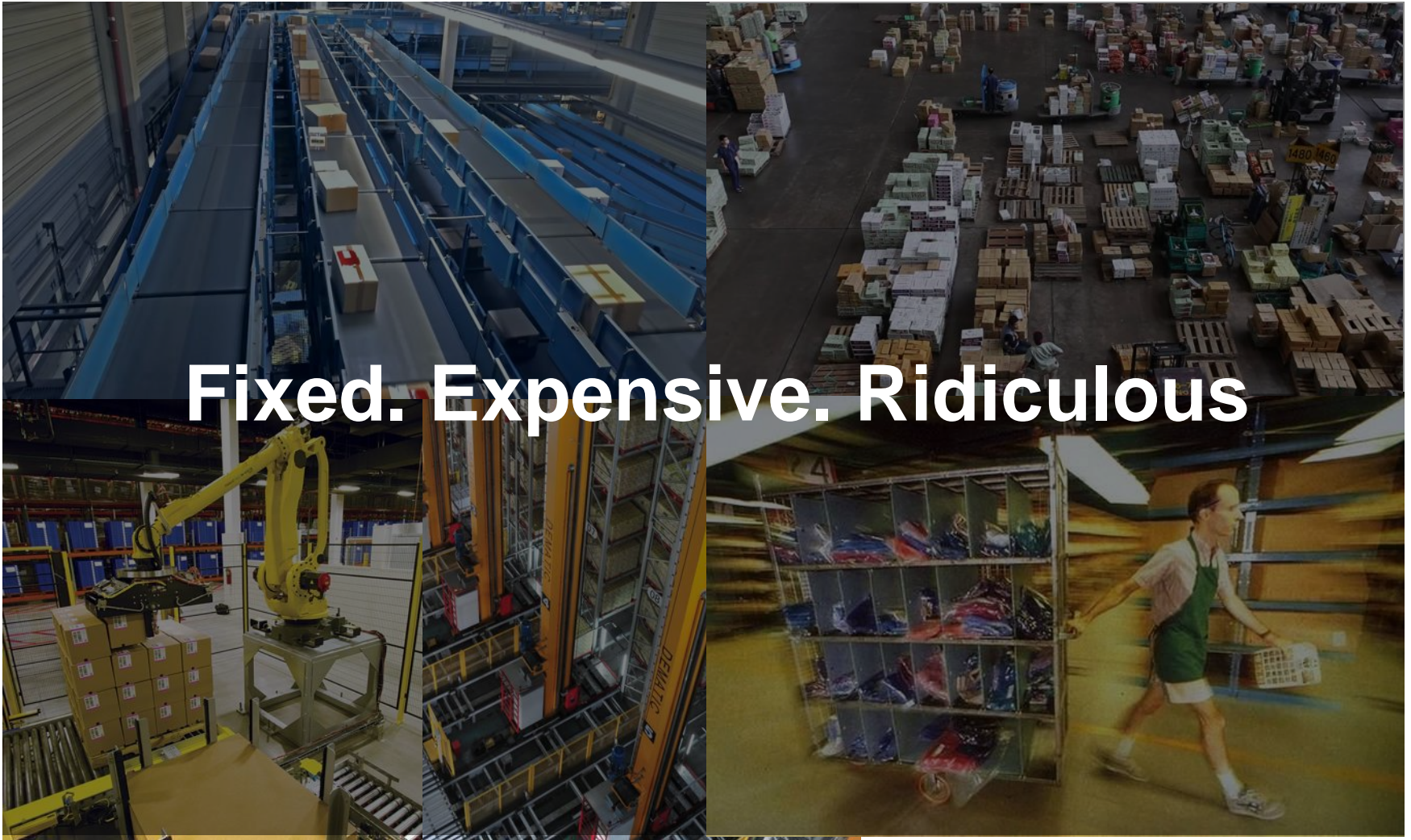
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The World Has Changed



- Traditional retail evolving
 - E-Commerce growth accelerating (\$500B+ by 2020)
 - Stores becoming regional fulfillment hubs
 - Customers demand better service levels → PrimeNow
- Transformational technology is far more accessible
 - A Tesla in every garage
 - Autonomous big rigs
 - Sensors and cloud pricing

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Trends Drive Economic Incentive

- Technology

- Miniaturization
- Open source
- Cloud based services



Reduced Cost

- Industry

- Shrinking retail footprint
- Tight labor markets
- Consumer behavior



Increased Benefit



**Economic incentive
(drives investment)**



Technology - Miniaturization

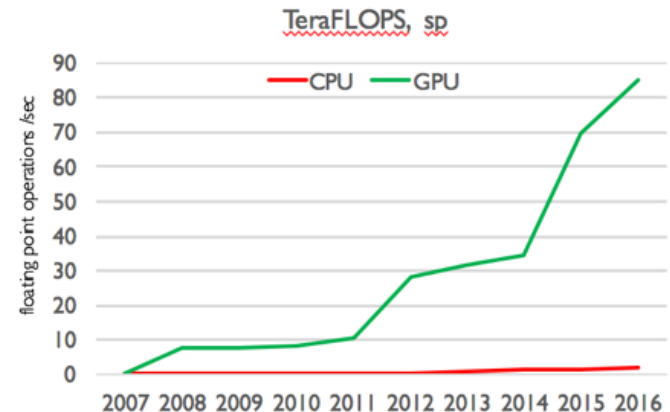
- Increased
 - Availability
 - Processing power
 - Plug-and-play
- Decreased
 - Form factor
 - Power consumption
 - Price
- Practical Example
 - Cost of Teraflop (2009) - \$48
 - Cost of Teraflop (2016) - \$0.05

credit: <https://en.wikipedia.org/wiki/FLOPS>

2009



2016



Credit: <https://www.mapd.com/>

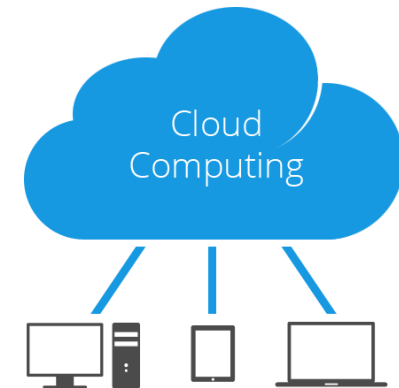
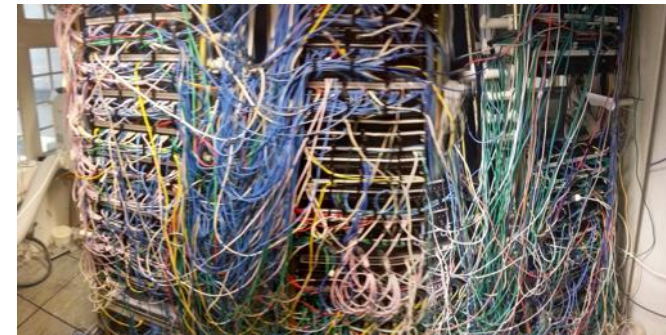
Technology – Open Source

- Early pioneers set the wheels in motion
 - Proprietary development locked us in
 - ROS alone has over 7.3M lines of code
- Impact
 - Accelerate development
 - Increased use of less expensive sensors
 - Reduce costs
- Practical example
 - Movement stack - 24 month → 2 months
 - Obstacle avoidance - 12 month → 2 weeks



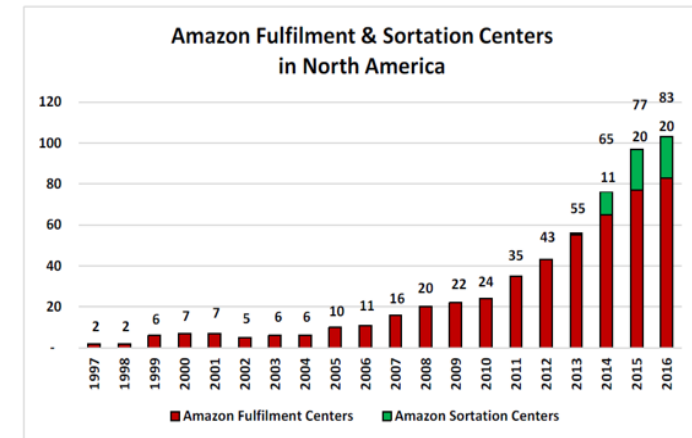
Technology – Cloud Services

- Portable power
 - No server rack
 - Have internet, will compute
- Impact
 - Zero infrastructure
 - Very fast install time
 - Reduce costs
- Practical Example
 - IT Infrastructure - 6 weeks → 2 days
 - Upfront cost - \$250K → \$500



Industry Trends Revisited

- Retail is Transforming
 - Retail landscape is changing daily
 - Distribution is fading in importance
 - Fulfillment (store and consumer) the priority
 - Traditional automation has met its limits
 - Labor markets are incredibly tight
- Impact
 - Billions announced in new fulfillment initiatives
 - Establishing flexibility at scale is the strategic differentiator
 - Retention and new sources of labor are vital



What does this mean for designs?

- Need for fulfillment vs. distribution capacity → Existing facilities require retrofitting to meet needs quickly
- Existing facilities currently have legacy layouts and designs → New automation needs to be flexible and minimally disruptive
- Labor shortages → Increase productivity, easy to use/train, change the nature of work (to attract new labor)

New Generation of Design

- Leverage technology trends
 - Develop on cloud based platforms
 - Leverages inexpensive sensors
 - Embed intelligence in devices
- Accessible to all size companies
 - Costs are decreasing
 - Buildings of all sizes can benefit
- Benefits
 - Installation – 18 months → 4 weeks
 - Payback – 5-7 years → < 18 months
 - Fully transportable



Practical Examples

- Building
 - Automation scales up or down → Old office space / retail space
 - Productivity increases → Lack of parking less of an issue
- Flexible storage
 - Collaborative → Eliminate need for GTP and grids
 - Eliminate conveyor and sorters → Minimize aisle width, maximize density
- Infrastructure
 - Cloud based → Reliable internet is nearly ubiquitous and failover is cheap
- Labor
 - System's ease of use → Requires less experience / skill

For More Information:

Speaker email: jerome@6river.com

Website: www.6river.com

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