Born Qualified

• Opportunities
  – Ubiquitous sensing (edge, cloud, fog…)
  – Big data
  – High performance and distributed computing

• Challenges
  – Aligning disparate data
  – Leveraging the digital twin (models) in design and manufacturing
  – Democratizing advanced manufacturing
  – Accelerating innovation / implementation of new products and processes
  – Integration into the manufacturing ecosystem
By the way, it works for Additive Manufacturing as well.
Next Generation Hybrid Capabilities
Connected Computing – The Starting Point

• Embedded computing platforms
  – Arduino (Real-Time DSP)
  – Raspberry Pi (LINUX Platform)
  – Particle Photon (Cloud-Based Platform)

• Computing – Cloud / Fog / Edge

• Low cost / disposable / rapidly upgradable
Research / Education / Workforce Development

Wireless Machine Monitoring System
Low-cost sensors:
- Vibration based PM
- OEE
- Coolant health

Wireless calipers and instruments

Part Production Process

Version 1 – Fall 2017
- More mass
- Thick center
- Complex inner profile

Version 2 – Spring 2018
- Less mass
- Thin center
- Simple inner profile

Part Production Process Data Analytics

Mobile App / Cloud / Deep Learning

- Surface finish
- Machine monitoring, material, and tool usage analytics
- Live run charts and notifications
ML/DL/AI – Leveraged as a Commodity
Democratization of Manufacturing

• Data driven, human augmented
• Established manufacturing “recipes”
• Crowd sourced model for manufacturing
  – Connecting customers
  – Ensuring quality / Born Qualified
  – Enhance & train operator / Democratize Technology
• Ensure economic prosperity and national security
Transforming the Manufacturing Ecosystem

Chen and Kurfess, 2017