System Engineering's Inflection Point: Are We Plumbers or Are We Pros?

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A Case Study in History: The NFL

The National Football League, Then and Now

The NFL had its origin as a league of part timers competing in local athletic clubs

- First paid player in 1892 William Heffelfinger, Allegheny Athletic Association first paid team
  - Competition was fraternal and local
- College Talent Pipeline Established in 1930's adds organization, structure, and discipline to prospects
  - Teams could have confidence that players from college knew the game, its rules
- Player specialization and substitutions allowed during World War II
  - Prior to substitution, players played all positions and every down

The National Football League, Then and Now

▶ Players in the early NFL often required jobs in other professions to support their family lives

- The first ever NFL #1 draft pick, Jay Berwanger, declined the offer and pursued a career as a foam rubber salesman

- Hall of Famer Chuck Noll was a salesman for Trojan Freight Lines in the offseason

- Hall of Famer Jim Houston ran an insurance and financial planning agency in the offseason

- Many other players were mill workers, plumbers and other types of laborers because the organization at the time did not provide sufficient motivation, incentives and support to transition to professional players

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The National Football League, Then and Now

▶ Today the NFL is an all professional league that attracts the best talent in the world with $11B in annual revenue

- Fully professional league with all highly paid players
  - A players only focus is game day success
- Organization that provides proper support and incentives for players to excel
  - NFLPA represents player interests and ensures they are well supported and well compensated
- Specialization among positions
  - Specialists can focus on their role and fully commit to it
- Competition occurs through strategy and tactics
- Business models that support virtuous cycles to continuously grow the NFL enterprise

What does that have to do with digital engineering?

Today's Digital Engineering Practice is like the early NFL

▶ There is traditionally little specialization among systems engineering practitioners (the coordinators)

- Expected to play all positions, every down. The depth of knowledge required for success is immense

▶ Relationships are fragmented between system representatives and engineering discipline representatives

- The coordinators must be able to drive the players towards the same goals

▶ Motivation, incentives, and support are lacking

- Organizations are inconsistent in providing these critical inputs to achieving success

▶ There is not a pipeline of talent with sufficient skills

- Until recently development of the skills necessary for a systems perspective was OTJ training

▶ The business models in place today do not support virtuous cycles

- Purpose and outcome should be the focus not staffing numbers or deliverable checklists

Our Profession is at an Inflection Point

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How do we successfully traverse the inflection point?

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Systems and Digital Engineers Must Specialize

While it is true that Systems Engineers are engineering generalists, the immensity and diversity of knowledge to effectively execute Digital Engineering is vast and will require specialization within SE

▶ Executing tasking traditionally done by systems engineers now requires

- Specialized digital tools for descriptive modeling

- A formal language

- Artful elegance

- Training for SE product consumers

- Knowledge related to additional tools to connect to other disciplines digital work product

- A cursory knowledge of even more specialized engineering disciplines

- A strong ability to communicate and lead

Organizations Must Structure Around Critical Relationships

With more specialization comes more depth and less breadth

▸ A systems engineer now must choose where to hone their skills within their own discipline (descriptive modeling, trade study analysis, modeling & simulation, ecosystems), while also understanding how to relate to all of the other specialized engineering disciplines and best represent their work product from a systems perspective

- More specialization = more organizational relationships = more communication

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Organizations Must Provide Sufficient Incentives and Support

Change is hard and people won't endure that pain without sufficient motivation to change. Organizations must provide the right incentives to encourage people to change while also providing the necessary support

▶ Everyone is motivated by different things

- Do people want to learn?

- Is the mission exciting?

▶ Incentives aren't just about money

- Do the incentives entice motivation?

▶ Without organizational support, change is that much harder

- Do your people have all they need to make the change?

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A Trusted Pipeline of Talent Must Be Established

Are there sufficiently skilled people to add to the team when you need them? By looking at available positions in the job market the answer seems to be no

▶ Why until recently has SE not been a full fledged academic discipline?

- With deeper specialization within SE, this is becoming necessary

- OTJ training has led to a fractured, inconsistent application of useful, purposeful practice

▶ Is it necessary for SE's to be fully competent in a specialized engineering discipline?

- Or is this just the required breadth that should be incorporated into the systems academic discipline

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Business Models of Digital Engineering Organizations Must Evolve

Can contracting for a specific number of people over a set period of time, or checking off a list of deliverables that worked in completely different circumstances lead to virtuous cycles?

▶ Everything your organization does should be aligned with an engineering outcome that supports the system's success

  • Check the box deliverables and PowerPoint engineering are wasteful and inefficient

▶ Can your success today be leveraged into greater success tomorrow for both your organization and its customers?

  • With the right business model in place success begets success

▶ Can your organization create win-win scenarios where companies are rewarded for producing more useful products?

  • Companies that can invest and innovate in digital engineering will bring customers greater mission success

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The Period of Fraternal Competition has Come to an End

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New Competitors are Ready for a Challenge

Are we plumbers, or are we pros?

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Questions?

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