

SE Leading Indicators Complexity Change (Thoughts, part 2)

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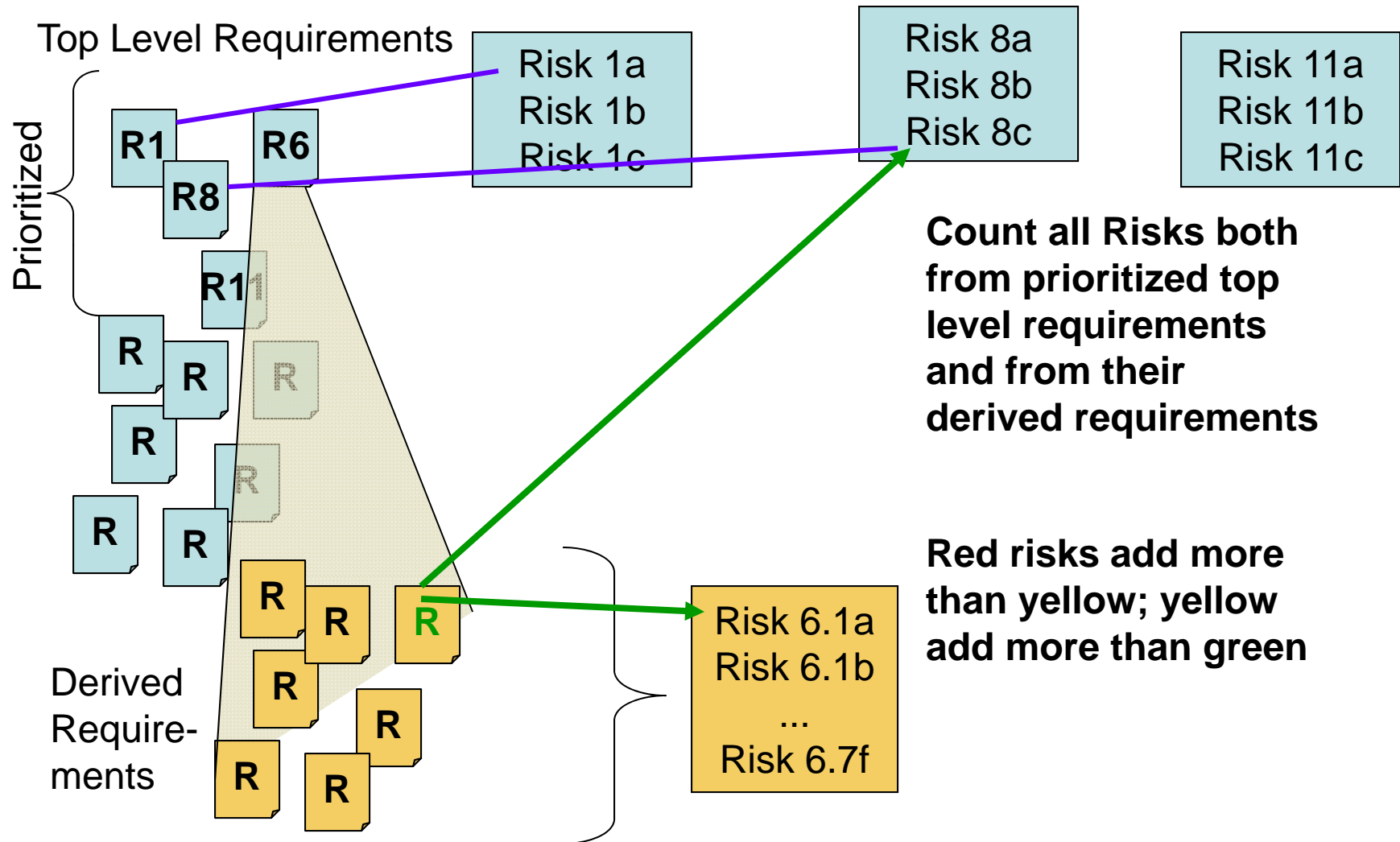
Thoughts

- From last time
- Issue
- Indications of complexity...which apply to SE?
- Types of complexity
- A process for getting to a Leading Indicator
- Backup

From last time

- Showed the next slide
 - Attempt at being specific enough to be usable
- Got no comments
- We weren't even particularly set on it
- Unclear whether this scheme is usable
- Want to approach from a different angle
- Go General

Touch Points



Issue

Widely applicable.....Specific

Unusable.....Usable

- With something new like a complexity measure, want to be both general and usable
- Consider, what do people think Complexity is that should be measured?
 - Stay general at first

Spectra -1

Less Complex	More Complex
Closed systems	Open systems
Clockwork systems	Swarm systems
Organized	Self-organizing
Weakly integrated systems	Highly integrated systems
Loose coupling	Tight coupling
Central control	Decentralized control
Single agents to pairs of agents	Infinites of agents

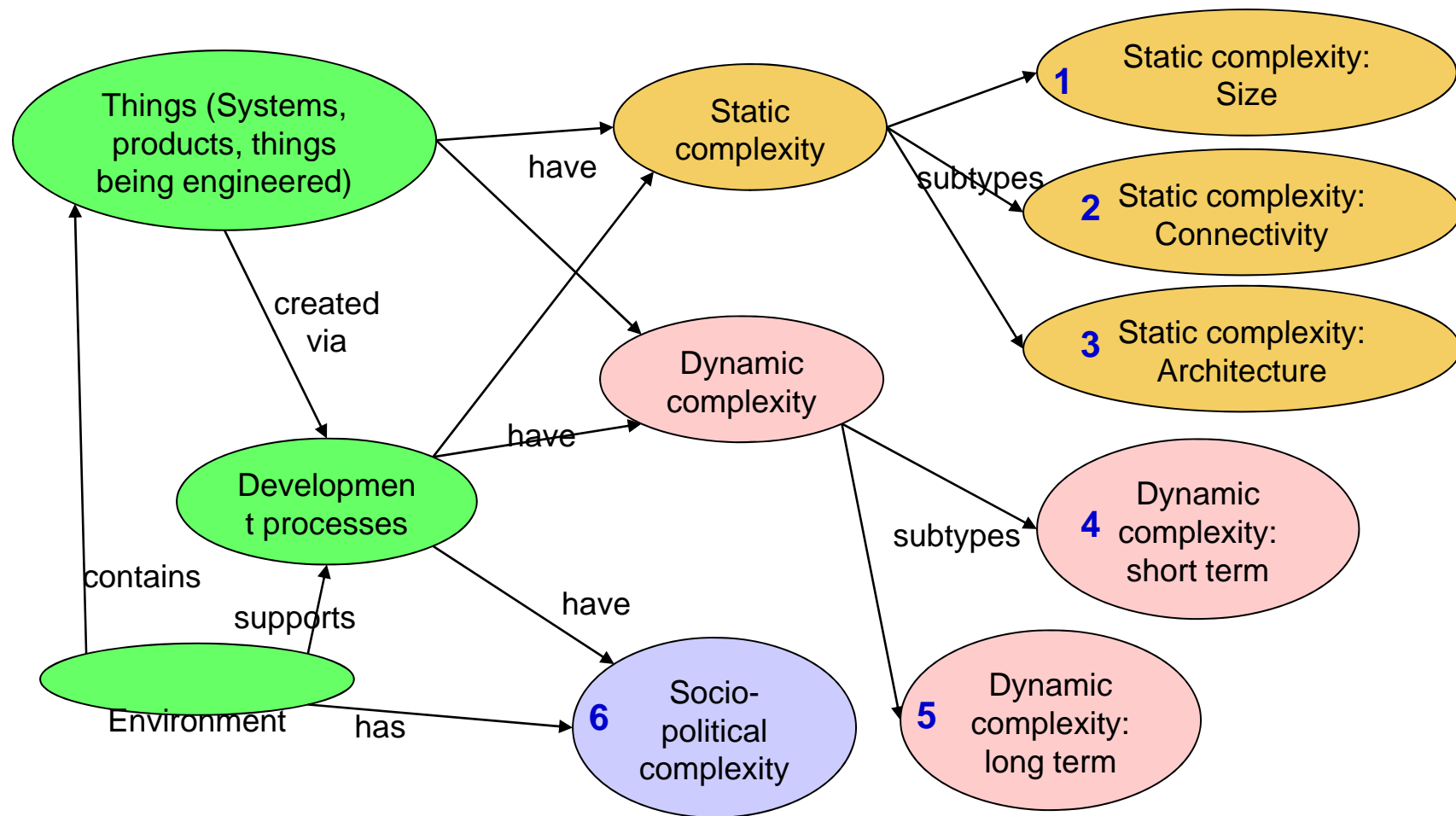
Spectra -2

Less Complex	More Complex
Understandable	Difficult to understand
Predictable	Unpredictable
Equilibrium	Chaos
Linear	Nonlinear
Control	Adaptability

Spectra -3

Less Complex	More Complex
Strict hierarchies	Networks
Simple behavior	Strategic behavior
Simple behavior	Emergent behavior
Clear cause and effect	Unclear cause and effect
Rigor	Richness
Economy of scale available	Economy of scale-killers
Single scale	Multi-scale
Reductionism works	Holism required

Theoretical types of complexity

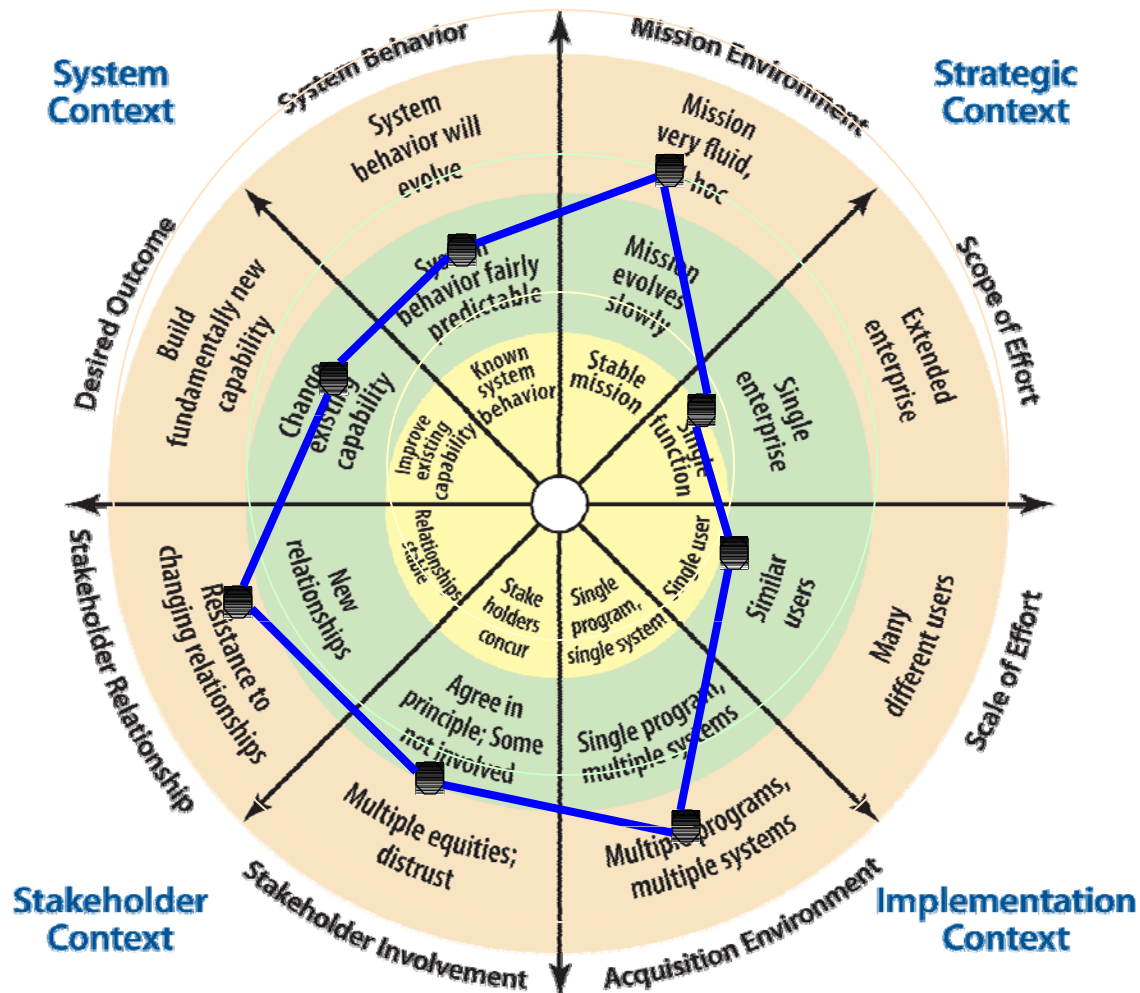


From Sheard's current doctoral work.

Conclusion: Be clear which one you are talking about.

Existing SE-Related Indicator for Type 6 (SocioPolitical)

Enterprise Systems Engineering Profiler™ of MITRE



- Traditional program domain
 - **Well-bounded problem**
 - **Predictable behavior**
 - **Stable environment**

- Transitional domain
 - **Systems engineering across boundaries**
 - **Influence vs. authority**

- Messy frontier
 - **Political engineering (power, control...)**
 - **High risk, potentially high reward**
 - **Foster cooperative behavior**

Source: Renee Stevens, "Engineering Enterprise Systems: Challenges and Prospects," Presentation to DAS XIII, 2006.

A process for getting to a Complexity Leading Indicator

- Suggest 3 questions for each type of complexity: Is this manageable, transitional, or completely unmanageable
- For Sociopolitical, use MITRE ESE profiler (Convert to a number)
- Ask programs to weight 6 types (normalized)
- Then the program can watch changes

What are you measuring the complexity of?

Use

Estimate:

**1 Manageable
2 Transitional
3 Messy Frontier**

x Weights

Sum

Things (Systems, products, things being engineered)

Development processes

Environment

1 Static complexity: Size

2 Static complexity: Connectivity

3 Static complexity: Architecture

4 Dynamic complexity: short term

5 Dynamic complexity: long term

6 Socio-political complexity

3

5

15

2

20

40

2

25

50

1

5

5

3

15

45

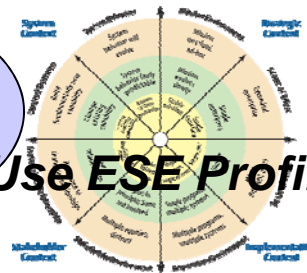
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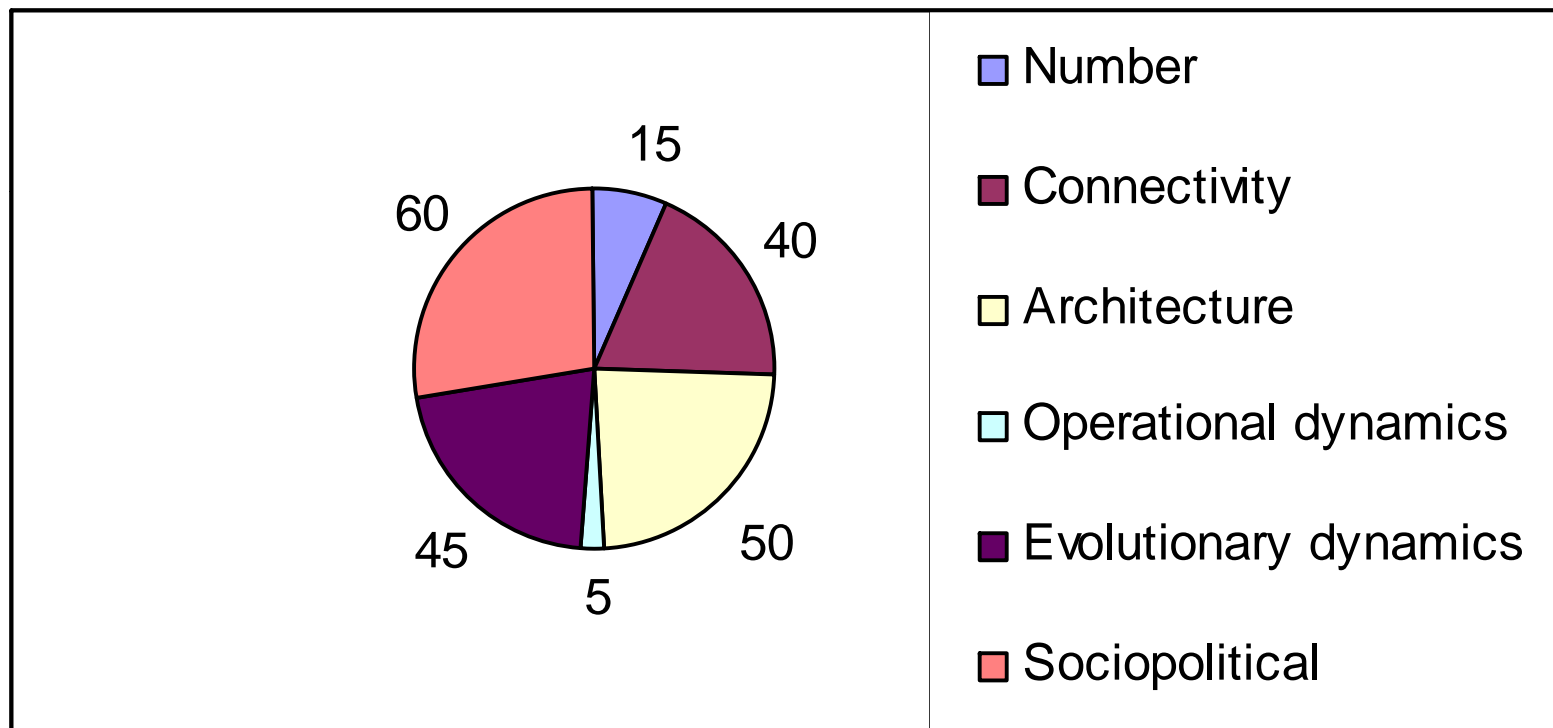
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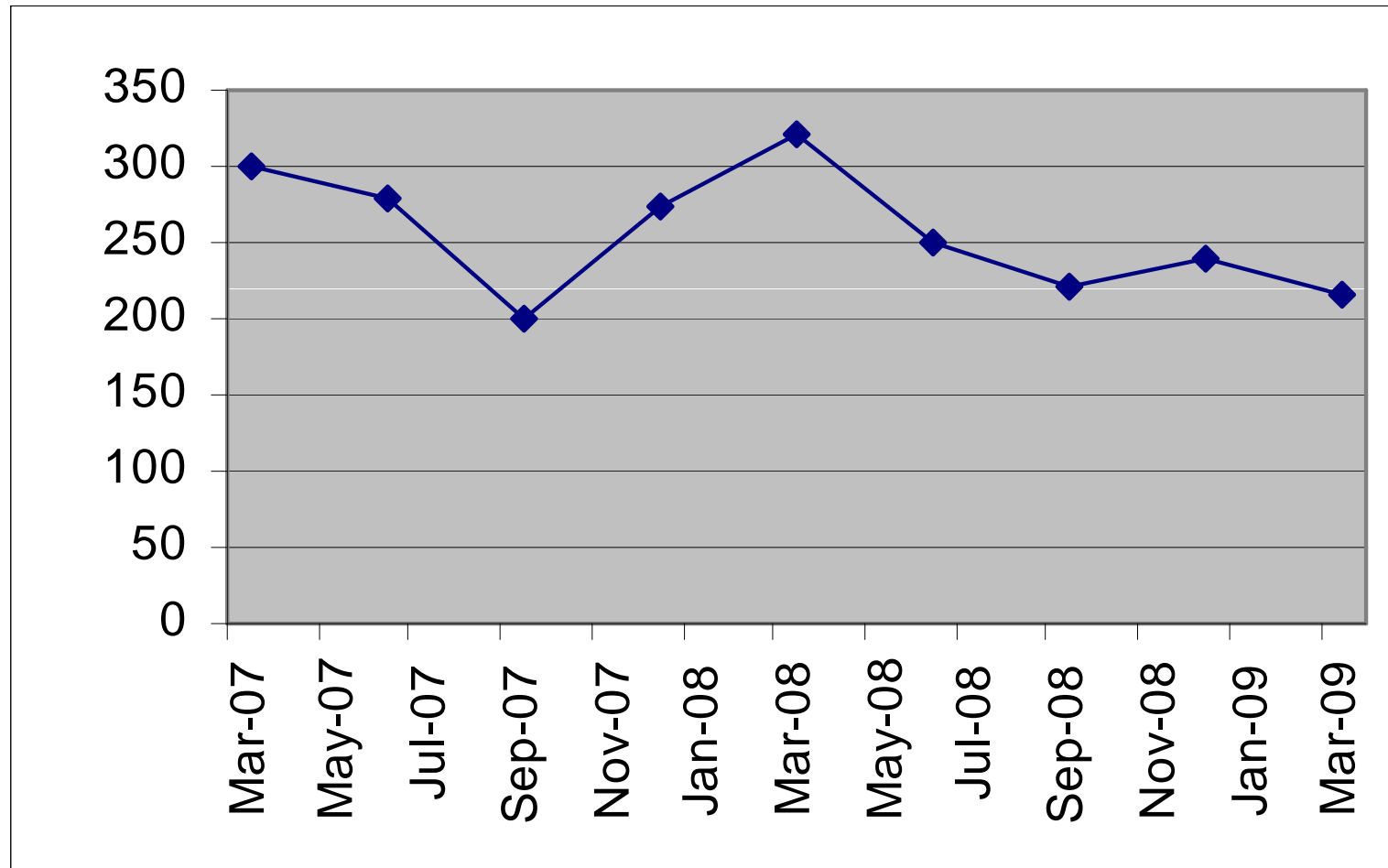
Use ESE Profiler, get a number



Complexity in Program 3/31/09



Program Complexity Over Time



Backup

- Charts from last time

Potential complexity?

(under the alternate approach)

- Association of prioritized top level requirements (TLRs) to risks (1)
- Association of prioritized top level requirements to the number of “touch points” (derived requirements to system level requirements – traceability) (2)
- Association of touch points to risks (existing or new ones based on derived requirements) (3)

(1) Used to establish base level complexity weighting

(2) Used to contribute (over time) to the base level weighting

(3) Additional contributor to the base level weighting

Prioritized Top Level Requirements

- Critical to customer (CTCs)
- Key performance parameters (KPPs)
- Measures of effectiveness (MOEs)
- Measures of performance (MOPs)

Any that drive risk identification going in will be complexity drivers.