The Future of Product Line Development at NASA

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A software product line is a set of software systems developed by a company that share a common set of core requirements but differ according to a set of allowable variations.

Examples:

- Satellite constellations (Earth Observing System)
- Ground systems (station antenna software)
- Crew/ground displays (similar look & feel)
- Interferometer fringe tracking software
- Robotic lunar fleet
- Wide range of COTS products used in NASA systems (EEPROM, web monitoring, etc.)
Faster development and system integration
Reduced time to market
Exploit commonality to get more reliable systems
  • Requirements: shared, optional, alternatives
  • Architecture: configuration of components and connectors
  • Decision model: set of choices for each system
  • Component and middleware code
  • Test suites
  • Safety and performance analyses
• NASA builds product lines (but usually doesn’t recognize that)
• NASA will build more product lines in the future (and is beginning to recognize that; note SEW’05 Gomaa tutorial)
• Software product-line engineering is a mature technology
  – SEI led the way; several good textbooks on product lines
  – Widely used in industry (Siemens, Avaya, Guidant, Rockwell Collins, Nokia, Daimler-Chrysler, ESA, etc.)
  – Has its own conference (SPLC since 2000, PFE since 1996)
  – NASA suppliers already use product-line technology
• NASA can benefit from widespread adoption of software product-line engineering practices
Product lines: measured against Tim’s criteria

- **Broad**: across systems, NASA faces issues of how to leverage commonality & manage variations in similar but non-identical systems
- **Far-reaching**: open research problems in architecture, requirements, performance & safety analysis, IV&V, testing
  - Research needed into V&V techniques to assure that delivered software for a new system meets product-line specs
- **Useful products**: good results shown in industry from even partial tech transfer of product-line techniques
- **Short-term benefit**: cost savings as similar systems are developed, practical framework for integration of evolving systems
We propose to identify, investigate, evaluate and apply product-line engineering techniques to NASA product lines in order to improve the timeliness, robustness and effectiveness of these future systems.