Accelerating Time-to-Market

Practical Techniques

Outline

- Four Intelligent Instrument Projects
- Design / Copy / Buy Target Electronics
- Comparison of two Hardware Architectures
- Comparison of two Software Architectures
- Domain Reuse
- Simulation Approaches
- Summary

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4 Intelligent Instrument Projects

	A	B	C	D
TTM	Late	Failure	Mixed	On-Time
Market	Success	--------	--------	TBD
Releases	Success	--------	--------	TBD
Target	Design	Design	Copy	Buy
SW Arch	Design	--------	--------	Buy
OOA	Yes	No	Yes	Yes

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Design / Copy / Buy
Target Electronics

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Target	Design	Design	Copy	Buy
SW Arch	Design	--------	--------	Buy
OOA	Yes	No	Yes	Yes

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Project A

	A	B	C	D
TTM	Late	Failure	Mixed	On-Time
Market	Success	--------	--------	TBD
Releases	Success	--------	--------	TBD
Target	Design	Design	Copy	Buy
SW Arch	Design	--------	--------	Buy
OOA	Yes	No	Yes	Yes

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Target Electronics A

- Initial Design 68000
  - Electronics completed on schedule
  - Software late
  - Insufficient CPU power
- Redesign with 68040
  - > 2 additional effort years

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Project B

	A	B	C	D
TTM	Late	Failure	Mixed	On-Time
Market	Success	--------	--------	TBD
Releases	Success	--------	--------	TBD
Target	Design	Design	Copy	Buy
SW Arch	Design	--------	--------	Buy
OOA	Yes	No	Yes	Yes

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Target Electronics B

- x86 custom design
- Each component functioned standalone
- Premature marketing announcement
  - Customers stopped purchasing existing product.
- Insufficient CPU power for concurrent component operation
- Company exhausted financial resources before hardware could be redesigned.

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Project C

	A	B	C	D
TTM	Late	Failure	Mixed	On-Time
Market	Success	--------	--------	TBD
Releases	Success	--------	--------	TBD
Target	Design	Design	Copy	Buy
SW Arch	Design	--------	--------	Buy
OOA	Yes	No	Yes	Yes

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Target Electronics C

- No senior EE available
- Attempted to copy working 68360 design
- Excessively long copy process
- Flaky hardware prototypes
- Not binary compatible with original design
- Unnecessary drain on software resources

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Project D

	A	B	C	D
TTM	Late	Failure	Mixed	On-Time
Market	Success	--------	--------	TBD
Releases	Success	--------	--------	TBD
Target	Design	Design	Copy	Buy
SW Arch	Design	--------	--------	Buy
OOA	Yes	No	Yes	Yes

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Target Electronics D

- No full time EE available
- Rapid component selection process
  - Credit-card sized 386 motherboard
- Plentiful and reliable target hardware immediately available
- Plug-in scalability to 486

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Comparison HDW Architectures

	A	B	C	D
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Project A HDW Architecture

- Electronics Team Driven
- Homebrew Design
- Single Processor (68040)
  - User / Remote Interface
  - Application Logic
  - Bit-Banging

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Project D HDW Architecture

- Software Team Driven
- Primary Components OTS
  - 386 Micro-Motherboard (CPU, Flash, RAM, Serial)
  - Ethernet
- Application Processor (386SX)
  - Interface, Application Logic
  - Soft real-time requirements (25 ms)
- I/O Processor (PIC Microcontroller)
  - Bit-Banging
  - Hard real-time requirements (50 µsec)

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Facilitate Software-Friendly Electronics

- Deal with the conflicting priorities up front by making explicit to management the tradeoffs between TTM and COGs.
- Select an OTS solution and integrate into your product rather than design from scratch.
- If an OTS solution is unacceptable, copy a working design (chip vendor's evaluation board)
- Reduce risk and improve prospects for product longevity by designing for scalability.
- Optimization takes time. Postpone COGs reductions till after initial release.

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SW Architectures A & D

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SW Architectures

	A	D
Host OS	UNIX	NT
Build Time	> 8 hours	< 0.5 hours
Target OS	pSOS	smx
Manufacturer	Homebrew*	MC-3020
Prog. Language	C++	C
Code + Data	> 10 MB	< 2 MB

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SW Architectures…

- Project A: Homebrew*
  - Multitasking
  - Lots of OS calls
  - Dynamic Memory Allocation
  - Multi-year team effort
- Project D: MC-3020
  - Single OOA Task resident within a Multi-Task system
    - Event Prioritization Mechanism (all benefits w/o load of MT)
  - No OS required (only system calls req'd for timer)
  - Static Allocation (Colorization)
  - Single part-time architect, 1 year

Domain Reuse between A & D

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Domain Reuse

- Reused three entire service domains
  - Primarily syntactic modifications required
- Application domain state models redone
  - Unable to meet COGs goal by assuming infinite CPU horsepower
- Major database service domain scrapped
  - Functionality integrated more efficiently into the application domain
  - Previous design assumed infinite memory available

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Simulation Approaches A & D

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Simulation A

- CASE Tool Simulation
  - Fantastic as a learning tool
  - Slow execution
  - Lots of work required to build test fixture
  - Difficult to interact with

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Simulation D

- Architecture targeted to host platform (NT)
  - Simulate multiple domains (entire system)
  - No construction of domain stubs required*
  - Execution speed orders of magnitude faster
  - Can integrate with real or simulated sensors/actuators
  - Enables use of powerful host development tools
  - Integrates with standard UI tools (VB ⇔ OOA DLL)

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Summary

- Select an electronics architecture conducive to software development.
- Faster to buy a software architecture than to build your own.
- Invest the extra $$$ in an efficient software architecture that will require minimal tuning so that developers can focus on the application.
- Adopt a simulation strategy that allows multi-domain execution in the host environment.

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