

Software Team Roles vs Skills, For Medical Device Development Teams

	Summary of responsibilities	Typical experience	Programming theory and practice	Software Development Lifecycle	Software Engineering Theory & Practice	Process familiarity and work habits	Leadership, followership, and teamworking attributes	Operating systems (or RTOS, or platform, etc) theory and practice	Toolkit familiarity or theoretical knowledge	Management theory, skills and toolkits	Product Development Process knowledge beyond software
Director or functional manager	<p>This should be structured as a strategic role, with a forward-looking window that may look 3-7 years into the future.</p> <p>Drives product and technology roadmaps for one or more products, possibly the company's entire portfolio.</p> <p>Creates organizational structures and strategizes organizational inventory in support of roadmaps.</p> <p>Drives software development & maintenance process to assure a control-vs-flexibility balance that is appropriate to the complexity and market niche of each product in the portfolio.</p> <p>If the incumbent in this position has never written any code, there is likely a gap in skills and perspective, BUT</p> <p>If the incumbent in this position is currently writing code, then there is probably a serious strategic gap, unless your company is a startup. In this case, your Director/Functional Manager will probably have to give up coding, eventually, or your strategic gap could become serious.</p>	Over 10 years	<p>General experience & usage of languages & tools of the types used by the team(s).</p> <p>Would rather organize and make decisions than write code, and may not have written any code for some time.</p>	<p>Experienced with multiple SLDC models. Can compare & contrast features of various models, eg Agile, Waterfall, Spiral, RAD, RUP, etc.</p> <p>Already has, or is obviously capable of quickly acquiring detailed knowledge of the SDLC in use.</p> <p>Knows one or more tools for test management.</p> <p>Has created a system or product from scratch (best) or was part of one or more teams that did so.</p> <p>Has supported a product in the field.</p> <p>Has retired a product.</p>	<p>Can analyze design Patterns for strengths & weaknesses. Use of Pattern nomenclature is desirable.</p> <p>Has been successful in</p> <ul style="list-style-type: none"> • Customer needs assessment • Requirements engineering • Integrating upper & lower CASE tools into a team's practices • Designing more than systems of at least the same complexity as, and technology similar to, the current product • Creation or integration of white box testing for code units, subsystems, inter-system interfaces • Integrating software and hardware subsystems <p>Understands appropriate use, and pros & cons, of black-box testing.</p> <p>Can analyze systems designs for throughput, resource consumption, maintainability.</p> <p>Analyzes systems designs for project management topics, such as organizational inventory, sequence of development,</p>	<p>Master black belt – has created or changed software processes and rolled them out to software teams.</p> <p>Broad theoretical understanding of configuration management for product and software for multiple parallel configurations (eg on-market and next-release, including CM for manuals, requirements, code, setup and i18n files, etc)</p>	<p>Inspires subordinates to cooperate and meet the company's needs, but also</p> <p>Protects subordinates from political pressure when appropriate</p> <p>Creates order from chaos</p> <p>Knows first-hand the thinking habits needed for each SW role</p> <p>Creates alliances with other functional groups</p>	<p>General experience usage of OS used by the team(s)</p> <p>Hands-on familiarity is nice-to-have</p>	<p>Excellent theoretical knowledge, hands-on experience is nice to have</p> <p>Has used similar compilers, upper & lower CASE, DBMS, IDE, etc in the past.</p>	<p>Master black belt in organizational behaviors for SW teams.</p> <p>Compares and contrasts organizational structures, eg matrix vs vertical orgs.</p> <p>Compares and contrasts scheduling & tracking theories, eg critical path vs critical chain.</p> <p>Can compare and contrast project management and development approaches, eg Scrum, Spiral, RAD, JAD, RUP, etc.</p>	<p>Knows budgeting, marketing, human resources.</p> <p>Can analyze, devise, compare & contrast Design Control systems; familiar with needs & practices in other Quality System components, mfg, marketing, sales, finance, field service, customer support, regulatory affairs.</p> <p>Master black belt expertise in Design Control and Risk Management.</p> <p>Strong in QSR, ISO 13485 and 14971.</p>

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					<p>scheduling, and integration planning, etc.</p> <p>Can compare and contrast approaches for product information model (eg traceability among deliverables).</p> <p>Can analyze feature subsystems vs aspect subsystems.</p> <p>Can design metrology for software engineering environments. Familiar with metrology approaches such as PSM (<i>Practical Software Measurement</i>) used by DoD.</p>						
Project manager	<p>Plans and tracks progress. Influences team-members to align with project priorities in real-time to enable continued progress. Focuses on schedule, but is extremely sensitive to product quality.</p> <p>This role is often held by the same person that holds the Technical Lead role, below.</p> <p>Note that <u>Project Manager</u> is best executed as an enabling role, such as is defined for the Agile role “Scrum Master”.</p>	<p>Over 3 years. Senior at 5 years.</p>	<p>General experience & usage of languages & tools of the types used by the team(s).</p>	<p>Already has, or is obviously capable of quickly acquiring, detailed knowledge of the SDLC in use.</p>	<p>Working familiarity with SW engineering deliverables of the types used by the product.</p> <p>Understands trace relationships among the various deliverable artifacts.</p> <p>Can understand relationships among system design components, eg subsystems & aspects.</p> <p>Can understand technology allocations of features to subsystems and aspects.</p> <p>Understands software engineering metrology</p>	<p>Good working knowledge of current practices or similar practices.</p>	<p>Inspires team members to cooperate and meet product needs</p> <p>Maintains priorities and communicates them to project team members</p> <p>Maintains diligence in balancing between schedule and product quality</p>	<p>General user skills.</p> <p>General awareness of OS features, eg processes, threads, message queues, driver relationships, image deployment.</p>	<p>Understand purposes of, and relationships between, applicable compilers, IDE, upper & lower CASE, DBMS, etc, used in the past.</p> <p>Good working knowledge of scheduling & tracking techniques and tools in use, or similar, eg Microsoft Project, Prochain, Scitor PSM.</p> <p>Familiar with project management and development approaches, in use, or similar, eg Scrum, Spiral,</p>	<p>Familiarity with organizational behaviors for SW teams.</p> <p>Understands roles and responsibilities in current (or similar) organizational structure.</p> <p>Good working knowledge of scheduling & tracking techniques and tools in use, or similar, eg Microsoft Project, Prochain, Scitor PSM.</p> <p>Familiar with project management and development approaches, in use, or similar, eg Scrum, Spiral,</p>	<p>Familiar with current or similar Design Control system; familiar with needs & practices in other Quality System components, mfg, marketing, sales, finance, field service, customer support, regulatory affairs.</p> <p>Well grounded in Design Control and Risk Management.</p> <p>Familiar with the contents of the QSR, ISO 13485 and 14971.</p>

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										RAD, JAD, RUP, etc.	
Technical Lead	<p>Directs daily progress during development and/or test of a product. Makes tactical technical decisions in support of product strategy. Also acts as a hands-on knowledge source and individual contributor.</p> <p>Takes a personal interest in especially gnarly bugs.</p> <p>Focuses on product quality, but is extremely sensitive to schedule.</p> <p>This role is often held by the same person that holds the <u>Project Manager</u> role, above, and/or the <u>System Architect</u> role, below, depending on the size and complexity of the product.</p>	<p>Over 5 years</p> <p>Senior at 10 years.</p>	<p>Intimate knowledge of programming approach, languages, etc, used for the product.</p> <p>Currently programs on a part-time basis.</p> <p>Would rather organize and make decisions than write code, but doesn't want to stop programming completely.</p>	<p>Already has, or is obviously capable of quickly acquiring, detailed knowledge of the SDLC in use.</p> <p>Knows how each deliverable affects understanding of the system, and communication of its content and intent.</p> <p>Understands, with nuance, the information value each step, or phase, or activity (depends on SDLC used) contributes to the final product and its proofs.</p>	<p>Same as <u>Director or Functional Manager</u>.</p> <p>Should be a UML (or other notation, eg DoDAF) user or expert.</p>	<p>Strong personal organization during past design and coding experience</p>	<p>Same as <u>Director or Functional Manager</u>.</p>	<p>Strong hands-on knowledge of the OS in use for the product.</p>	<p>Strong hands-on knowledge of tools in use for the product, or similar, including compiler, IDE, upper & lower CASE, test tools.</p>	<p>Highly aware of organizational behaviors for SW teams.</p> <p>Understands the organizational structure(s) in use.</p> <p>Understands the in-use (or similar) scheduling, tracking, project management and development approaches and tools.</p>	<p>Same as <u>Project Manager</u></p>
System architect	<p>Negotiates highest level system requirements with external stakeholders.</p> <p>Determines architecture and the application system's high-level design.</p> <p>Participates with Marketing and Director to develop product and technology roadmaps. Makes real-time, strategic technical decisions.</p> <p>Acts as technical arbiter on requirements decisions, may oversee the requirements engineering process.</p> <p>Takes a personal interest in especially gnarly bugs.</p> <p>Probably makes decisions on toolkits, IDEs, lower CASE tools.</p> <p>May also perform the role of <u>Technical Lead</u>, above.</p>	<p>Over 10 years.</p>	<p>Is probably currently coding. Has been an excellent, senior programmer. In a small team, continues to act in this capacity.</p> <p>In a larger team, or when combined with other roles, may not be coding, but has an excellent theoretical grasp of the languages and tools in use.</p>	<p>Same as <u>Technical Lead</u>.</p>	<p>Same as <u>Director or Functional Manager</u>.</p> <p>However, the System Architect should be a god in the areas of requirements engineering, architecture, and design.</p> <p>Should be a UML (or other notation, eg DoDAF) expert.</p>	<p>As senior in programming environment habits as <u>Technical Lead</u>.</p> <p>Almost as senior in other areas as <u>Director/Functional Manager</u> should be. Might not be personally appropriate as a leader of process changes, but should have the sophistication to design new processes and practices.</p>	<p>Should be an excellent influencer and teamworker.</p> <p>Should be a natural leader, although may not have the urge to manage. It can be difficult to find a very experienced System architect who has management experience.</p>	<p>Same as <u>Technical Lead</u>.</p>	<p>Same as <u>Technical Lead</u>.</p>	<p>Same as <u>Technical Lead</u>.</p>	<p>Same as <u>Technical Lead</u>.</p>

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Requirements engineer	<p>Captures and negotiates customer needs.</p> <p>Analyzes needs for, and defines, system behaviors and characteristics. May build Risk Analysis. May manage traceability.</p> <p>Depending on product complexity, may be highly specialized.</p>	<p>Junior: 3 years</p> <p>Typical over 5 years</p> <p>Senior, specialized 10 years.</p>	Should have some past experience designing from requirements, or extensive experience working with designers.	Same as <u>Project Manager</u> .	<p>Must be adept at differentiating requirements from design.</p> <p>Should have ingrained habits of graphically-driven analysis modeling.</p> <p>Best if very familiar with UML diagrams used for analysis and requirements.</p>	Meticulous organizer of information. Deeply ingrained habits of version control and configuration management.	<p>Adept at using influence, and building cooperative working relationships with team members.</p> <p>Sufficiently assertive to resolve opinion conflicts among stakeholders.</p>	Same as <u>Project Manager</u> .	<p>Requirements elicitation tools such as DOORS and Raven.</p> <p>Modeling tools, such as Software Through Pictures, Rhapsody, Visual Paradigm, etc.</p>	Can participate in operation of practices and tools currently in use, either immediately, or with modest training.	<p>Knows Design Control and Design Transfer.</p> <p>Knows marketing process for eliciting customer needs.</p> <p>Has experience with customer-facing elicitation.</p>
Subsystem designer or architect, or senior program	<p>Similar to System Architect, but less experienced. Negotiates details of system or software requirements and designs. Creates implementation designs within the context of the system design.</p> <p>In a smaller environment, a subsystem designer is often a senior programmer. In a very complex system or large environment, the design component of the work may require all of the subsystem designer's time, and programming activities are delegated.</p>	5 years	Senior programmer.	Same as <u>Technical Lead</u> .	<p>Similar to <u>System Architect</u>, but is at the stage of understanding the motivations, nuances and ramifications of an existing system design, rather than being able to create it.</p> <p>Can create subsystems within the context of a system design.</p> <p>Can contribute strongly to functional requirements.</p> <p>Strong working understanding of the project notation, eg UML.</p>	Similar to <u>Technical Lead</u> .	<p>May direct programmers and testers.</p> <p>Fosters a cooperative and orderly approach.</p> <p>Sufficiently assertive to resolve opinion conflicts among stakeholders.</p>	Similar to <u>Technical Lead</u> .	Can participate in operation of practices and tools currently in use, either immediately, or with modest training.	Similar to System Architect, but aware of the topics to be learned in order to become a system architect or technical lead.	
Systems programmer or toolsmith	<p>In small environments, this role is likely to be shared by the more senior programmers</p> <p>Designs, codes, tests scripts and tools used by designers, programmers, testers.</p> <p>May craft or configure architectural subsystems such as interprocess communications, databases, web servers, etc. Because of the many possibilities, this role may be shared among</p>	<p>Junior 5 years</p> <p>Senior 10 years</p>	<p>Junior, eg scripting: essentially an <u>Application Programmer</u> for non-customer-facing features.</p> <p>For server admin (web, DBMS, etc) may have basic programming skills, but, eg, be an advanced DBA.</p> <p>For architectural</p>	Senior: same as <u>Technical Lead</u> .	<p>Senior toolsmith: expert at requirements elicitation among technical people.</p> <p><u>Subsystem architect</u> level of design skill.</p> <p>Junior: executes instructions from more experienced designer, sys admin, etc.</p>	Toolsmith: Highly organized, but (senior) also has exposure to many other work styles besides his/her own. Facilitates efficiency and efficacy of others.	Service, helper and mentor mentality, depending on seniority.	<p>If writing architectural support software, knows the OS cold. Master Black Belt knowledge of the OS internals.</p> <p>For specialized subsystems, eg web server, DB server, etc, may have specialized knowledge in one area, without senior knowledge</p>	<p>Senior: Expert knowledge in designed, administered or supported tools.</p> <p>Junior: working knowledge.</p>	Can participate in operation of practices and tools currently in use, either immediately, or with modest training.	N/A

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	several people for different tools or subsystems.		systems and tools, is a senior programmer.					in other areas.			
Application programmer	Writes code, creates unit tests	3 years Senior at 5 years. Next step up is subsystem architect.	Good working knowledge of the languages and platforms in place.	Executes instructions. Is familiar with SDLC, but requires oversight.	Executes instructions from more experienced designer or programmer. Designs classes and subclasses, but may require oversight.	Maintains priorities Tracks tasks Scrupulous about CM	Focuses on tasks. Gets help when required. Anxious to learn and grow.	Can make applications work in the OS environment.	Can participate in operation of practices and tools currently in use, either immediately, or with modest training.	N/A	Design Control and awareness of Risk Management practices.
Test Manager, V&V Functional Manager, V&V Director Because this is a SW-focused description, clinical-evaluation-specific management is not shown.	Directs test team leads for testing efforts that are conducted separately from development, scoped across multiple products or simultaneous projects. Has responsibility for planning headcount and budget vs product roadmap and technology roadmap. These test efforts are typically structured as systems integration and feature testing activities. Unit testing activities are arguably best performed by the authoring programmers.	Depending on complexity of product(s) and organization, 5-10 years	<u>Application Programmer</u> level of skill, but with a cognitive style more suited to investigation of existing objects.	Same as <u>Technical Lead</u> .	<u>Subsystem Architect</u> level of skill, but with a cognitive style more suited to investigation of existing objects. Very strong in test engineering. Very familiar with customer-facing roles.	The most anally organized person you've ever met. Carefully plans test impacts of changes, Scrum sprints, or other iterative development steps. Very strong drive to know that proof statements are correctly crafted, and are backed up with strong test engineering. Habitually sticks to the written documents. Works from facts and data, not conjecture about what seems likely.	Assertive enough to survive when all the activities that precede testing slip their schedules, and V&V has only 5 minutes remaining to do months of work. Inspires staff to be objective in the face of pressure. Works closely with development leadership. Very strong understanding of CM, record-keeping, and DHF organization.	Best: Same as <u>Subsystem architect</u> . Acceptable: Same as <u>Application Programmer</u>	GUI test tools, static analysis tools, white-box test tools, build process.	Same as <u>Project Manager</u> .	Design Control, Design Transfer, ISO 14971 Risk Management
V&V or Test Lead	Directs routine testing efforts that are conducted separately from development scoped to a single product and a single concurrent project. These test efforts are typically structured as systems integration and feature testing activities. Unit testing activities are arguably best performed by developers.	5+ years	Acceptable at <u>Application Programmer</u> level of skill. Must be able to understand and apply practices and needs of end users.	Same as <u>Technical Lead</u> .	Understands the system design and its representation. Understands code at the module level. Understands software test theory and practice. Understands software metrology, eg PSM.	Same as <u>Test Manager</u>	Same as <u>Test Manager</u>	Same as <u>Test Manager</u>	Same as <u>Test Manager</u>	Can participate in operation of practices and tools currently in use, either immediately, or with modest training.	
Functional tester	Test the customer-facing aspects of the product . This person may have a	3+ years	Might not be a programmer.	Same as <u>Application Programmer</u> .	May not have much understanding of software engineering, but is literate and facile	Excellent record keeper.	Collaborative.	Same as <u>Project Manager</u>	Must be able to learn test tools in use for black-box	N/A	Knows the customer world

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	background in the device's market, eg as a medical technologist, X-ray tech, lab manager, etc.				with computers and applications that are similar to the product.				testing		
Structural tester	Writes harnesses and scripts that automated challenges to subsets of the product so as to maximize exposure of defects and provide as much troubleshooting information as possible.	3+ years	Acceptable at <u>Application Programmer</u> level of skill. There's a paradox, see "SW Engineering", at right.	Same as <u>Subassembly Architect</u>	Must be able to understand the system design and domain interfaces (eg HW-SW interface).	Same as <u>Subassembly Architect</u>	Same as <u>Subassembly Architect</u>	Same as <u>Subassembly Architect</u>	Same as <u>Subassembly Architect</u>	N/A	Same as <u>Subassembly Architect</u>
Software Quality Assurance Director or Functional manager	Compliance assurance: <ul style="list-style-type: none"> • Are we complying with QSR and our processes & procedures? • Are the plans complete? • Are the records complete and correct? • Is the DHF auditable? Design QA (aka V&V – see those roles, below): <ul style="list-style-type: none"> • Will it work? • Did we prove it? These functions may be either separate of joined, depending on the product and organization. Directs software compliance assessments. Participates heavily in software process definition. Negotiates compliance strategy & tactics for tough projects. Allocates SQA staff to development projects.	10+ years	Has education or some practice in languages similar to those in use. Acceptable at <u>Application Programmer</u> level of skill, in the past. May not have practiced recently.	Same as <u>Director or Functional Manager</u> .	Demonstrates understanding of the entire body of engineering theory in use, but probably doesn't have the cognitive style best suited to requirements engineering or design. Understands test engineering. Probably does have the cognitive style best suited to test development.	Process familiarity same as <u>Director or Functional Manager</u> . Cognitive style: reviewer & tester. Expert reviewer. Extremely detail-oriented. Best when can differentiate between the actuality of compliance and mere audit convenience. Skilled auditor. Expert audit representative.	Similar to <u>Director or Functional Manager</u> . Views the compliance component of SQA as a service and teamworking function, but has the assertiveness to negotiate compliance and review topics.	Acceptable at <u>Application Programmer</u> level of skill, in the past. May not have practiced recently.	Acceptable at <u>Application Programmer</u> level of skill, in the past. May not have practiced recently.	Same as <u>Director or Functional Manager</u> .	Same as <u>Director or Functional Manager</u> .
Software Quality Assurance engineer or specialist	Facilitates and supports compliance with software process, eg may facilitate defect management and change management boards.	3+ years Should have had success in developing and	Has education or some practice in languages similar to those in use. Acceptable at		An SQA engineer SQA can understand the design. An SQA specialist can tell if the documents	Cognitive style: aptitude and skills as a reviewer and tester. Extremely detail-oriented. Best when can differentiate	Views the compliance component of SQA as a service and teamworking	Same as <u>Project Manager</u>	Similar to <u>Project Manager</u>	N/A	Very familiar with QSR ISO 14971 Risk Management

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	<p>Reviews software deliverables for Quality and Compliance issues.</p> <p>Performs software audits and compliance assessments.</p>	<p>testing software.</p> <p>Good SQA candidates often had mediocre records as developers due to development throughput issues, ie understood the work, but were slow or junior programmers.</p> <p>Excellent SQA'ers often paid dues in programming, when their This is a cognitive style is more suited to SQA.</p>	<p><u>Application Programmer</u> level of skill, in the past.</p> <p>May not have practiced recently.</p>		<p>and records are compliant, but may not understand the design.</p> <p>Whether these functions are joined or separate, depends on the complexity of the product and the size of the organization.</p>	<p>between the actuality of compliance and mere audit convenience.</p> <p>Developing as an auditor and audit representative.</p>	<p>function, but has the assertiveness to negotiate compliance and review topics.</p>				<p>Product development processes</p>
Configuration manager	<p>In a small group, this role is frequently held by the same person as <u>Configuration management engineer</u>, below.</p> <p>Devises processes & procedures to create software builds. Designs directory structures, CM interfaces to IDEs. Is a core definer of project information organization.</p> <p>In a complex system or product line, maintains CM for all documents and software objects.</p> <p>Note that both product and non-product SW require CM.</p>	<p>When managing a complex function, could require a real people-manager, eg 7 years or more.</p> <p>When combined with <u>Configuration management engineer</u>, might be less 3-5.</p>	<p>Has education or some practice in languages similar to those in use. Acceptable at <u>Application Programmer</u> level of skill, in the past.</p> <p>May not have practiced recently.</p>	<p>Excellent: same as <u>Technical Lead</u>.</p> <p>Acceptable: same as <u>Project Manager</u>.</p>	<p>Same as <u>Application Programmer</u>.</p>	<p>Meticulous record keeper.</p> <p>Process knowledge same as <u>Project Manager</u>.</p>	<p>Process-management-oriented leadership style and organizational approach.</p> <p>Service-oriented teamworking outlook.</p> <p>Understands CM stakeholder communities inside SW, but also outside, eg Field Service, Mfg, QA.</p>	<p>Similar to an IT Systems Administrator for the platform(s) in use.</p> <p>Eg in Linux, understands OS packages, library locations.</p> <p>In .NET, understands deployments, service packs, hotfixes.</p>	<p>Expert with build tools, CM tools in use.</p> <p>Strong working knowledge of administration for IDE in use.</p> <p>Can compare and contrast CM tools.</p>	<p>Same as <u>Project Manager</u>.</p>	<p>Same as <u>Project Manager</u>.</p>
Configuration management engineer	<p>In a small group, this role is frequently held by the same person as <u>Configuration manager</u>, above.</p> <p>Executes instructions to create software builds. Maintains directory structures, CM interfaces to IDEs. Is a core maintainer of project information</p>	<p>Less than 5</p>	<p>Basic programming skills with the language(s) and tools currently in use.</p>	<p>Generally same as <u>Project Manager</u>, but is <i>extremely</i> familiar with project milestones, Scrum sprints, etc.</p>	<p>Same as <u>Application Programmer</u>.</p>	<p>Meticulous record keeper.</p> <p>Process knowledge same as <u>Project Manager</u>.</p>	<p>Service-oriented teamworking outlook.</p> <p>Executes instructions.</p>	<p>Similar to an IT Systems Administrator for the platform(s) in use.</p> <p>Eg in Linux, understands OS packages, library locations.</p> <p>In .NET,</p>	<p>Strong with build tools, CM tools in use.</p> <p>Strong working knowledge of administration for IDE in use.</p>	<p>N/A</p>	<p>Can participate in operation of practices and tools currently in use, either immediately, or with modest training.</p> <p>Understands</p>

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	organization.							understands deployments, service packs, hotfixes.			

Links

Project management tools wiki: http://en.wikipedia.org/wiki/List_of_project_management_software
 Functional requirements for software engineering wiki: http://en.wikipedia.org/wiki/Functional_requirements
 UML wiki: http://en.wikipedia.org/wiki/Unified_Modeling_Language
 UML group: <http://www.uml.org/>
 Upper CASE wiki: http://en.wikipedia.org/wiki/Computer-aided_software_engineering
 IDE wiki: http://en.wikipedia.org/wiki/Integrated_development_environment
 PSM (Practical Software Measurement) site: <http://www.psmc.com/>
 About the QSR (Quality System Regulation, 21CFR820): <http://www.fda.gov/CDRH/DEVADVICE/32.html>

Development Model Links:

Iterative development model: http://en.wikipedia.org/wiki/Iterative_and_incremental_development
 Agile development wiki: http://en.wikipedia.org/wiki/Agile_software_development
 Waterfall development wiki: http://en.wikipedia.org/wiki/Waterfall_model
 Spiral development wiki: http://en.wikipedia.org/wiki/Spiral_model
 Vee Model software development: [http://en.wikipedia.org/wiki/V-Model_\(software_development\)](http://en.wikipedia.org/wiki/V-Model_(software_development))
 Dual Vee Model for systems development wiki: http://en.wikipedia.org/wiki/Dual_Vee_Model