

Real World System Development

November 17, 2016

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#1 Terps

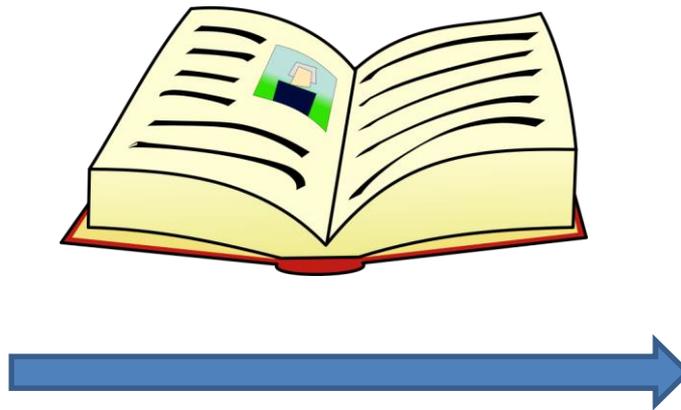


Does not include...

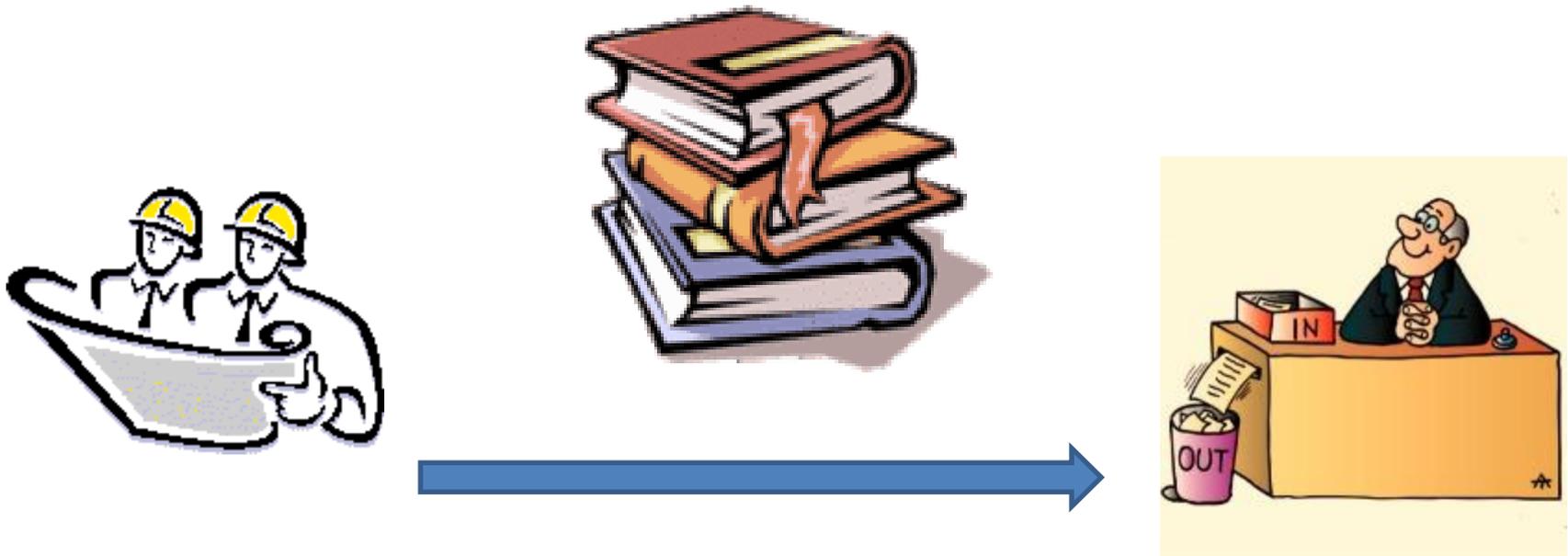
- Educational research projects
- App development
- Open source development (although some elements are the same)

In the beginning...

- The customer issues a “Request For Proposal”
 - Describes in varying level of detail what they want



Contractor responds with a Proposal



- Proposal content complies with the RFP (mostly)
- Usually includes a Management Volume, Technical Volume and Cost Volume
- RFP preparation is intense

Winner is announced



Loser may decide to lodge a formal protest

Development Methods

- Waterfall
 - Requirements are detailed
 - Systems built to satisfy requirements
 - System tested against requirements
 - System delivered to Customer
- Agile Methods
 - Iterative; all requirements not detailed up front
 - Customer gives feedback during development

Phases include

- System Architecture
- System Design
- Software Design
- Software Development
- Many testing levels
- Delivery

Requirements

- System requirements decomposed into several “levels”
- Traceability between levels is maintained
- Automated tools needed for large systems with 1000s of top level requirements
- Requirements are mostly documented as “shalls”; there is an art to writing good requirements

System Reviews

- Architecture is usually included in proposal
 - Customer may give feedback upon award
- Preliminary Design Review (PDR)
 - System partitioning and decomposition of requirements is the focus
 - MilStd term for decomposed units is “Computer Software Configuration Item” (CSCI)
- Software Design Review (SDR)
 - Given PDR partitions, next level of decomposition
 - No software code yet

Software Development

- Starts with the Design from SDR and allocated requirements
- Done in the context of the software architecture
 - E.g., “a three tier web architecture using an SQL database”
- Highly dependent on the programming language(s) selected and infrastructure available

Elements of SW Development

- Requirements mapping
- Inspections
 - A review of the end product (code, configuration data, etc) by others
 - May be done in a room or virtually
- Initial testing
 - Intended to make sure individual pieces work before putting them together

Other SW Development topics

- “Test Driven Development”
 - Write the test cases first, before writing code
 - Generally the development infrastructure would assist in running and recording the results of testing
- “Pair Programming”
 - One of the Agile Development concepts
 - Two people work side-by-side (one keyboard and screen) to develop the code

... Continued ...

- Code Style Guides
 - Meant to ensure common conventions followed for the source code
 - Enables an easier understanding by other team members
- Static Analysis
 - Before inspection, tools run on source code
 - Check that style is followed, and catch other potential bugs

... Continued ...

- Source code configuration management (CM)
 - Is needed from the start
 - Generally, a “committed” baseline is maintained that the developers think works
 - CM allows changes to be easily backed out
 - Becomes even more important when managing several releases

Testing Levels

- Unit Tests
 - First level of software tests
 - Want to ensure all paths through the units are covered by tests; tools may report on coverage
- Software Integration Tests
 - Test CSCI level integration (if possible)
 - Initial testing against requirements

More testing

- System Integration Tests
 - Puts CSCIs together
 - May include automation for running tests, keyboard simulators, etc.
 - Requirements are tested
- System Sell Off Tests
 - Witnessed and certified by the customer
 - Significant payment upon completion

Specialized Tests

- Max Stress Workload
 - Ensure that the agreed to loads, number of users, etc. can be handled
- Long Duration Tests
 - May need to run the system for days
 - Good for catching memory leaks
- Cutover tests
 - For systems that must be updated in real time

Maintenance

- Many releases may be maintained concurrently
 - Fielded
 - About to be fielded
 - In development
- Significant effort needed to keep track of what's in each release
 - Especially as bugs are reported from the field; do they need to go into the next release, or get fixed immediately

More Maintenance

- Tools and databases are needed to keep track of it all
 - Issues (bugs), Features (new in next release) are mapped to:
 - Requirements
 - Releases
 - Software Units
 - Various tests
 - “JIRA” is a popular tool for this

Conclusion



Research in Industry

- Companies with mega-bucks can afford to do moon-shot projects
 - Used to be AT&T, IBM
 - Now Google, Facebook
- Government contractors are contractually allowed to spend a certain amount on research
 - Each project is evaluated with the potential impact on the bottom line