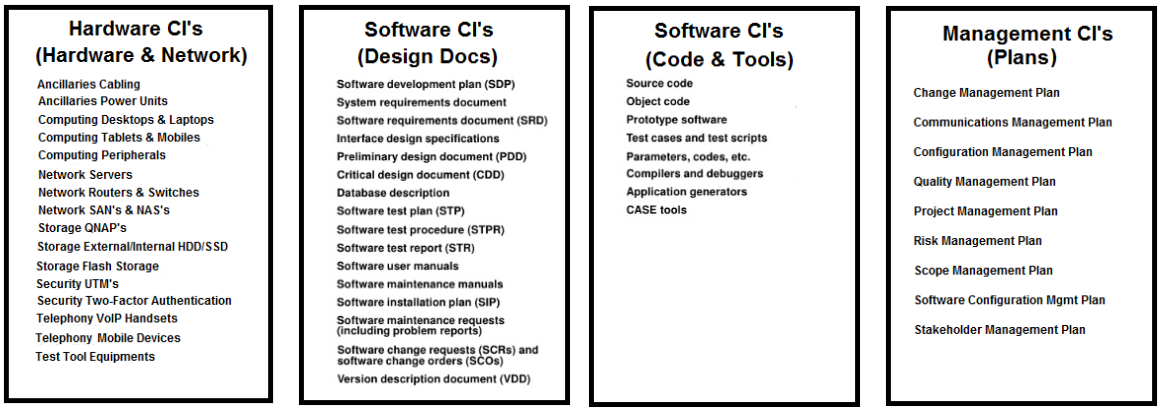
Configuration Management (CM)

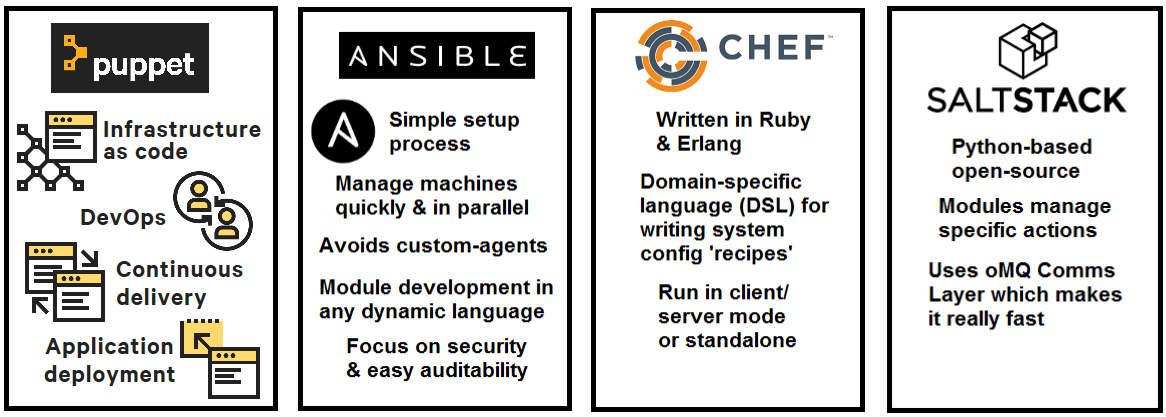
A joint project management and systems engineering governance type process for establishing and maintaining consistency of a product's performance, security, quality, functional and physical attributes with its requirements, design and operational information throughout its life. The aim is to ensure the proper accounting of an enterprise's configuration items (CIs)/service items and maintain the appropriate interrelationship between them in the operational and test/reference environments. With the emphasis on the functional relationship between the parts, subsystems and external systems for effective control of system baselines and subsequent changes, it is vital that the appropriate taxonomy is used and it is applied to the right levels of enterprise. The CM process is broken down into six generic disciplines, which are planning and management, configuration identification, integrator management and interface control, configuration change control, configuration status accounting and finally configuration verification and audit.

Configuration management has been traditionally done using manual configurations, custom scripts, golden disks/images, ad-hoc practices or other bespoke/outdated tools. This could result in occasions when unauthorised configurations or IT components are used or detected in use, incidents and problems are unable to be traced back to changes, change requests were not completed successfully (poor impact assessments, incorrect data in the database or poor version control), licences have been wasted or not used appropriately, or exception reports are not captured during configuration audits. Time can be wasted identifying users that have locked files and forgotten about it, thereby not allowing other users to modify it.

Selected examples of Design, Hardware, Software & Management Configuration Items include:



Examples of automated open-source configuration management systems/tools include:



Configuration Management follows products and services through their development and operational lifecycle, so it can be considered in two parts. The first part relates to the storage of entities required to design, develop, build and test, whilst the second part relates to the production, release management, change management, engineering support, maintenance, ILS, upgrade and eventual disposal of the products. Both of these parts go beyond asset management, because it also involves and is influenced by IT financial management, systems on the market (e.g. outsource management), IPR and other legal mechanisms (e.g. rights management), risk and technology/manufacturing readiness levels, security and environmental factors, current and future business processes and roles (including knowledge management, people skills and experience) and data resilience (e.g. archiving and re-use).

Some of the management challenges associated with CM include:

- Properly scoping CM activities and then appropriately funding them;
- A documented CM process that helps people understand what is required, what their role in helping the business deliver the outputs/outcomes, as well as an owner of the process that can be consulted either for clarifications or edits/modifications;
- Establishing the roles associated with CM and creating/running a Change Control Board/ (Configuration Item Control Authority) and levels of authority/responsibility in terms of making 'approved' changes/recommendations and controlling changes to stop 'non-approved' issues from taking place;
- Determining the principles for how a configuration audit will be established and monitored;
- Establishing the level to set CI's, what information needs to be captured and how future CI's will be created/sourced/evolved/derived/discontinued, that will be recorded in some type of segregated development/master/archive repositories with version control (ideally with the named contributor/editor as well);
- Wrapping meta-data around unstructured CI's (requirements, design specifications, source code and executable code, licences, test specifications and data, log information, user documentation, library and supporting software, SLAs, bug reports and resolutions) that allow a complete picture to be established and reported on;
- The process of managing and incorporated business systems (IT business processes, workflows, pathways) and other custom-built components/applications/patterns;
- The process of setting baselines/patterns, and managing changes within baselines or passing them forward to future baselines;
- The process of rolling out a new baseline and having the ability to rollback if necessary;
- The process of establishing design principles to help facilitate forward and backward compatibility between baselines;
- The capability of automatically determining approved baselines within systems and flagging up non-approved elements using Health Usage and Monitoring Systems (HUMS) or other active/passive 'universal' enterprise/federated discovery mechanisms;
- Linking the CM system to other external systems, including other supply chain, logistical, financial and ERP systems;
- Analysing the CM management information and providing appropriate management reports to display the single version of the truth, upon which decision making can take place;
- As with every process there should be methods of recording lessons learnt (what went well; what didn't go so well), making suggested improvements (as part of a CI process) and undertaking a periodic review to check the process is still valid for the organisation;
- Managing the deltas, such as interim baselines and exceptions is always a challenge.

Further Reading

1. ESA Software Engineering Standards, ESA PSS-05-0 Issue 2 February 1991.
2. IEEE Standard Glossary of Software Engineering Terminology, ANSI/IEEE Std 610.12-1990.
3. ANSI/IEEE Std 1042-1987, IEEE Guide to Software Configuration Management.
4. IEEE Standard for Software Configuration Management Plans, ANSI/IEEE Std 828-1990.
5. Managing the Software Process, Watts S. Humphrey, SEI Series in Software Engineering, Addison-Wesley, August 1990.

Best Practices

1. ISO. 2003. *Quality Management Systems – Guidelines for Configuration Management*. Geneva, Switzerland: International Organization for Standardization (ISO), ISO 10007:2003.
2. ANSI/EIA 649: National Consensus Standard for Configuration Management.
3. MIL-HDBK-61A: Configuration Management Guidance.
4. MIL-STD-100G: Engineering Drawing Practices.
5. ASME Y14.100M: Engineering Drawing Practices.
6. CMMI: CMMI for Systems Engineering Software Engineering and Integrated Product and Process Development.

Selected Books

1. Quigley, J.M. & Roberston K. L. (2015) Configuration Management: Theory, Practice, and Application, Auerbach Publications.
2. Aiello B. & Sachs L. (2010) Configuration Management Best Practices: Practical Methods that Work in the Real World.
3. Blanchard, B.S. and W J. Fabrycky (2005) *Systems Engineering and Analysis*, 4th ed. Prentice-hall international series in industrial and systems engineering. Englewood Cliffs, NJ, USA: Prentice-Hall.

Selected Links

1. http://sebokwiki.org/wiki/Configuration_Management
2. INCOSE Tools database working group (TDWG). in International Council on Systems Engineering (INCOSE) [database online]. San Diego, CA, USA, 2010. Accessed April 13, 2015 Available at: http://www.incose.org/docs/default-source/wgcharters/tools-database.pdf
3. ANSI/GEIA. 2005. *Implementation Guide for Configuration Management*. Arlington, VA, USA: American National Standards Institute/Government Electronics & Information Technology Association, GEIA-HB-649. October 2005
4. ISO/IEC/IEEE. 2015.*Systems and Software Engineering*-- *System Life Cycle Processes*. Geneva, Switzerland: International Organisation for Standardisation / International Electrotechnical Commissions.ISO/IEC/IEEE 15288:2015
5. SEI. 2010. *Capability Maturity Model Integrated (CMMI) for Development*, version 1.3. Pittsburgh, PA, USA: Software Engineering Institute (SEI)/Carnegie Mellon University (CMU).
6. https://cmpic.com/configuration-management-books.htm
7. https://mplaza.pm/prince2-configuration-management-strategy-template/
8. http://searchservervirtualization.techtarget.com/feature/Better-configuration-management-strategies-for-IT-pros