

Configuration management of a system of interdependent standards

presented by

Serena Coetzee serenacoetzee@gmail.com

Centre for Geoinformation Science, University of Pretoria, South Africa

co-authors

Simon Cox simon.cox@csiro.au

CSIRO, Earth Science and Resource Engineering, Kensington, WA, Australia

John Herring john.herring@oracle.com

Oracle, New England Development Center, Nashua, NH, United States of America

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Geographic information everywhere



Spatial data infrastructures



Demand
for
standards!

- Spatial data infrastructure
 - Make spatial data usable to as wide an audience as possible
 - Technology, agreements, legislation, resources...
 - National
 - Canada, Germany, Netherlands, US, South Africa, India, Australia...
 - Regional
 - **IN**frastructure for **SP**atial **InfoR**mation in **EU**rope (INSPIRE)
inspire.jrc.ec.europa.eu
 - International
 - UN Global Geospatial Information Management ggim.un.org





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Geographic information standards

- ISO/TC 211, *Geographic information/Geomatics*

www.isotc211.org

– ISO 19100 series of standards

- ISO 19111, *Geographic information – Spatial referencing by coordinates*
- ISO 19115, *Geographic information – Metadata*
- ISO 19160, *Addressing*

– 49 published standards to date

– ISO has a three year cycle of systematic reviews

- ±10 standards approved for revision



Geographic information standards

- Open Geospatial Consortium (OGC)



www.opengeospatial.org

- Industry consortium of 400+ members
- KML, GeoRSS, Sensor Observation Service, GeoAPI, ...
- 2000+ implementations of standards/specifications, some certified to be compliant
- Change requests from the public trigger revisions

Geographic information standards

- ISO TC/211 and OGC Joint Advisory Group (JAG)

- Coordinate standard development

- Jointly developed standards

- OpenGIS Web Map Server Interface (WMS)
 - Spatial SQL (Simple feature model)
 - Geography Markup Language (GML)
 - Observations and Measurements



Normative dependencies

Relationship between two standards where a change to the normative content in one standard affects the normative content of the other standard

Coetzee, 2011

Example

Scope of ISO 19126:2009, Geographic information – Feature concept dictionaries and registers

This International Standard specifies a schema for feature concept dictionaries to be established and managed as registers. ... These registers are in accordance with ISO 19135.

Normative dependencies

Example

ISO 19109:2005, Geographic information – Rules for application schema

GF_TemporalAttributeType represents a temporal attribute, which **shall** be used as the time reference characteristic of a feature. A temporal attribute type **shall** have a TM_Object as value type. The structure of TM_Object is defined in the Temporal Schema described in ISO 19108.

Normative dependencies

- Circular dependencies
 - ISO 19112:2003 → ISO 19115:2003 → ISO 19112:2003
- Chain of dependencies
 - ISO 19115:2003 → ISO 19112:2003 → ISO 19111:2003
→ ISO 19108 → ISO 19107 → ...
- Between ISO/TC 211 and OGC standards
- Dependencies on 'external' standards
 - W3C, IETF, OMG, UN FAO, ISO/TC 204, *Intelligent Transport Systems*, ...

Challenge

If the normative content of a standard is changed, which standards are affected?

In which order should revisions be done?

How to write standards so that it does not matter...

UML and XML artefacts

- Harmonized Unified Modeling Language (UML) model
 - Single harmonized model of UML in all ISO/TC 211 standards
 - Published by ISO/TC 211 (read/free access to the public)
 - For model-driven development
 - Implementers of ISO/TC 211 and OGC standards
- EXtensible Markup Language (XML) repositories
 - ISO/TC 211 and OGC each have repository of XML
 - For data validation
 - Implementers of ISO/TC 211 and OGC standards

Challenge

How to maintain integrity in the harmonized UML model/XML repositories when there are multiple versions of UML packages/XML namespaces?

Implementers may use any combination of standards (including 'old' standards)

Compliance testing

- Test suites are required for compliance testing
 - ISO: Hard to find requirements
 - OGC: Requirements not specified consistently

One, two, three or four requirements?

ISO 19111:2007, Geographic information – Spatial referencing by coordinates

A coordinate tuple **is an** ordered list of n coordinates that define position of a single point. In this International Standard the coordinate tuple **shall** be composed of one, two or three spatial coordinates. The coordinates **shall** be mutually independent and their numbers **shall** be equal to the dimension of the coordinate space.

Challenge

How to build a test suite when the requirements are difficult to find?

IEEE SWEBOK

- IEEE software engineering body of knowledge (SWEBOK)
 - Describes what a software engineer should know
 - Knowledge areas
 - Software requirements, design, construction, testing, maintenance, **configuration management**, engineering management, engineering process, tools and methods, quality

IEEE SWEBOK, 2004

Software configuration management

- System
 - Collection of *components organized to accomplish a specific function* or set of functions
- Configuration
 - The *functional and/or physical characteristics* of hardware, firmware, or software, or a combination of these as set forth in technical documentation and achieved in product

IEEE SWEBOK, 2004

Configuration management

identifying the configuration of a system
at *distinct points in time*
for the purpose of systematically
controlling changes to the configuration and
maintaining *integrity and traceability* of the
configuration
through the *system life cycle*

IEEE SWEBOK, 2004

Configuration Management

Management of the CM process

Configuration identification

Configuration control

Configuration status accounting

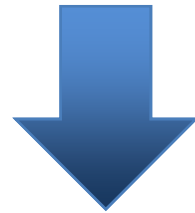
Configuration auditing

Release management and delivery

IEEE SWEBOK, 2004

Methodology

Describe
ISO/TC 211 configuration management
according to
IEEE SWEBOK's configuration management



Improvements to ISO/TC 211
configuration management?

Management of the process

Configuration Management	Management of the CM process
	Configuration identification
	Configuration control
	Configuration status accounting
	Configuration auditing
	Release management and delivery

Manage the configuration by establishing and maintaining a plan that fits the organizational context

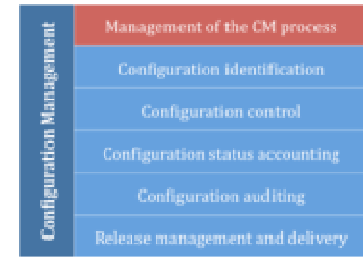
- Organizational context
 - ISO/TC 211, *Geographic information/Geomatics*
 - 63 member bodies (32 P, 31 O)
 - 50 liaisons
 - *Joint Advisory Group (JAG)*
 - *Programme Maintenance Group (PMG)*
 - *Terminology Maintenance Group (TMG)*
 - *Harmonized Model Maintenance Group (HMMG)*
 - *XML Maintenance Group (XMG)*

Management of the process

Configuration Management	Management of the CM process
	Configuration identification
	Configuration control
	Configuration status accounting
	Configuration auditing
	Release management and delivery

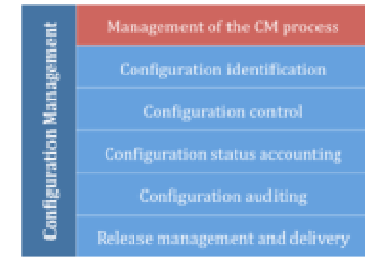
- Constraints and guidance
 - ISO project approach
 - NWIP → WD → CD → DIS → FDIS → IS → review
 - ISO harmonized stage codes
 - 00 → 10 → 20 → 30 → 40 → 50 → 60 → 90
 - Decisions by member body votes
 - e-ballot
 - Plenary

Management of the process



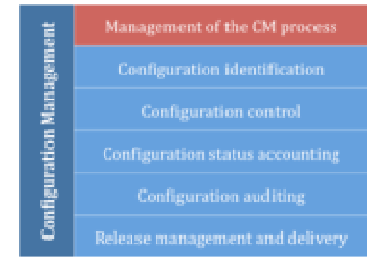
- Planning
 - Organization and responsibilities
 - Chairman, Secretariat, Working Groups (~sub-committees)
 - *PMG: harmonized standards*
 - *TMG: harmonized terminology*
 - *HMMG: harmonized UML model (rules, tools)*
 - *XMG: harmonized XML repositories (rules, tools)*
 - Resources and schedules
 - Project leaders, editors and experts
 - ISO/TC 211 publication schedule

Management of the process



- Planning
 - Interface control
 - Identifying interfacing items and how changes to these will be communicated
 - *Dependencies between standards (interfacing items) have to be documented*
 - *Changes to normative elements (potential interfacing items) should be clearly identified in the revision*

Management of the process



- Surveillance
 - Measures and measurements
 - Ballots or call for comments at different stages
 - Members bodies
 - Liaisons
 - *PMG: ensure harmonized standards*
 - *HMMG: ensure correct, harmonized UML*
 - *XMG: ensure correct, harmonized XML*
 - *TMG: ensure harmonized terminology*

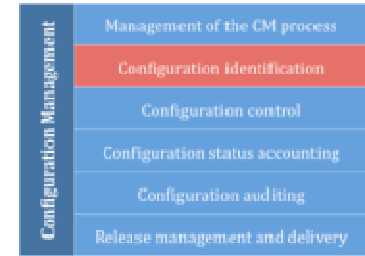
Configuration identification

Configuration Management	Management of the CM process
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Identifies items to be controlled, identification schemes, versions, tools, techniques

- Items
 - Currently in ISO: standard
- Item relationships
 - Currently in ISO: normative references

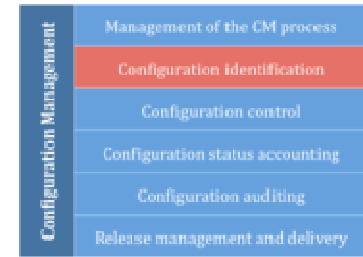
Configuration identification



- Standard A uses a single type T defined in Standard B
- Standard A may or may not have a normative reference to Standard B
- Standard B is revised into B'
- Is Standard A still harmonized with Standard B'?

You have to study A, B and B' to know...

Concept of a modular standard Configuration identification

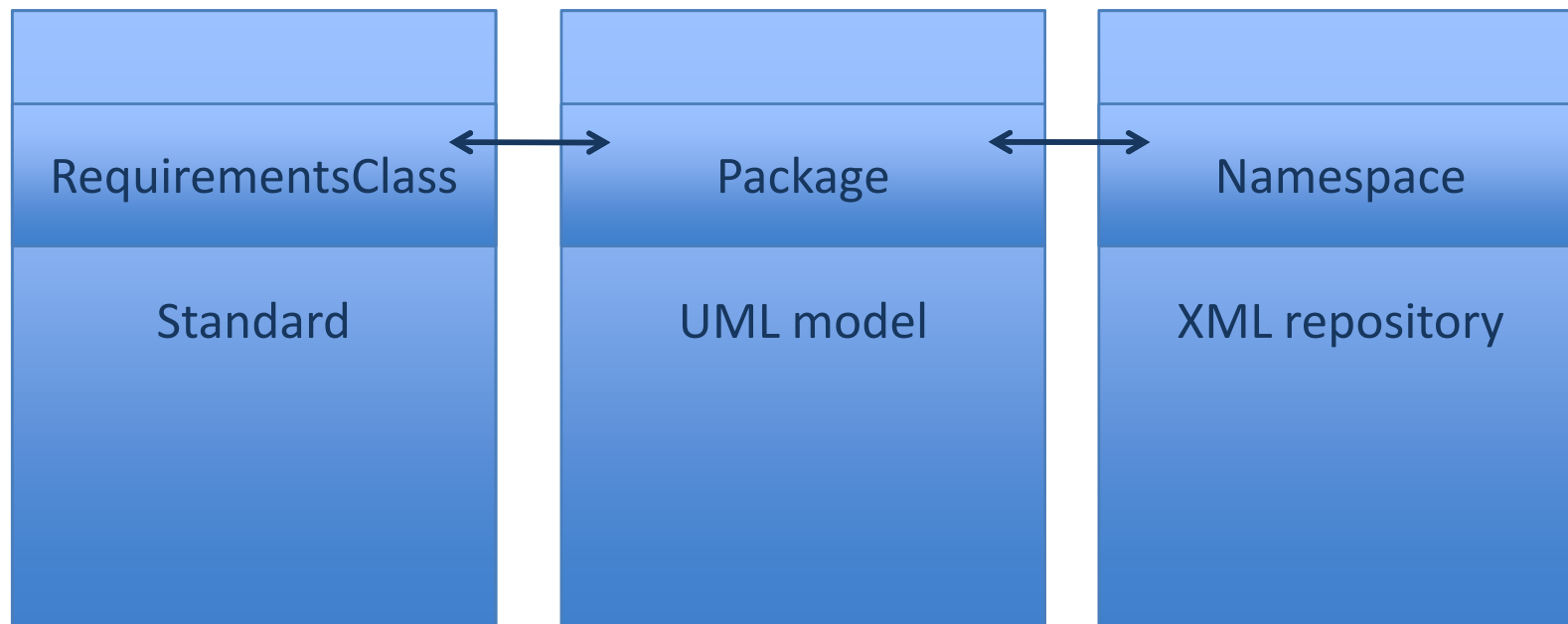


OGC, 2009

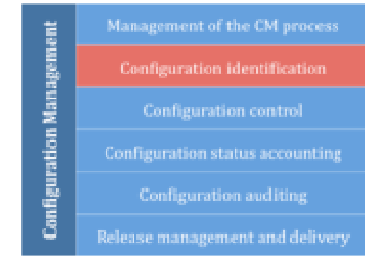
Configuration identification

Configuration Management	Management of the CM process
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- 1. Configuration unit = RequirementsClass*
- 2. Record dependencies between configuration items*
- 3. Record changes to configuration items in the revision*

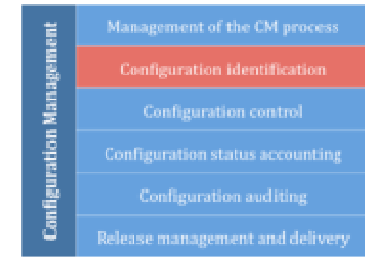


Configuration identification



- Versions
 - ISO harmonized stage codes
- Baseline (current approved configuration)
 - Changes whenever a standard is published
 - *Harmonized UML model and XML repositories have to be in synch with standards*

Configuration identification



- Library
 - ISO/TC 211 document register
 - LiveLink
 - Published standards available on www.iso.org
 - Nationally adopted standards through member bodies
 - Joint publications on the OGC website

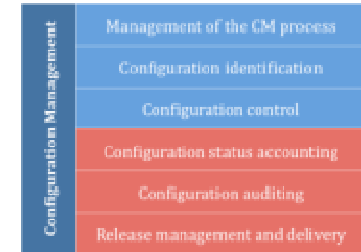
Configuration control

Configuration Management	Management of the CM process
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Managing change: which changes, approval, support, scope deviations

- Member bodies
 - Propose changes (revision) in new work item proposal (NWIP)
 - Exercise their right to control by voting on the NWIP
- ***PMG, TMG, HMMG, XMG influence control by submitting comments***
- Scope deviations
 - Ballot (according to ISO Directives, Part 1)

Status & accounting, auditing, release management and delivery



- Configuration status & accounting
 - Recording and reporting information
 - Website
- Configuration auditing
 - Independent evaluation
 - Comments by member bodies, public review, ...
- Release management and delivery
 - Publish ISO standard, UML model, XML repository

Results

- Recommendations for ISO/TC 211
 - Configuration item = RequirementsClass
 - Record dependencies/interrelationships between configuration items
 - Record changes to configuration items in the revision
 - Use automated tools for configuration status reporting and tracking
 - More detailed recommendations in document 211n3165: 'Report and recommendations from the ad hoc group on strategy for configuration management and backwards compatibility'

Limitations

- ‘External’ standards do not follow the modular approach...
 - How does one record a dependency?
 - e.g. to a sub-clause number

Future

- ISO/TC 211
 - Implement recommendations
 - Harmonize configuration units
 - RequirementsClass = UML package = XML namespace
- OGC
 - Modular approach implemented since 2010
 - Initial resistance from editors, now acceptance
 - Positive effect
 - Readability of standards
 - Development of test suites for compliance testing
 - To be done: case studies and quantitative evaluations
- Can the modular approach be used to improve other standards?
 - e.g. ISO 9001 (quality management), ISO/IEC 20000-1 (service management) and ISO/IEC 27001 (security)...

Conclusion

- A standard is not a novel
- A standard should not be regarded as a text publication
- Modular approach is widely accepted in software and hardware configuration
 - Why not in standards?

Acknowledgements

- Contributions to the work on standard maintenance and configuration
 - ISO/TC 211 members
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Thank you
