

# Configuration management of a system of interdependent standards

presented by

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ORACLE

# Geographic information everywhere



# Spatial data infrastructures

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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](http://inspire.jrc.ec.europa.eu)
  - International
    - UN Global Geospatial Information Management [ggim.un.org](http://ggim.un.org)





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# Geographic information standards

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

[www.isotc211.org](http://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

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- Open Geospatial Consortium (OGC)



[www.opengeospatial.org](http://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

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- 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

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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

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## *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

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- 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

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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

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- 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

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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

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



# IEEE SWEBOK

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- 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

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- 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

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*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

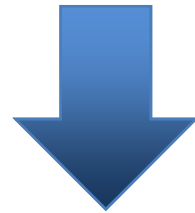
Release management and delivery

*IEEE SWEBOK, 2004*

# Methodology

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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

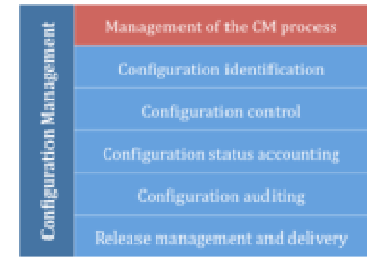
- Organizational context
  - ISO/TC 211, *Geographic information/Geomatics*
    - 63 member bodies (32 P, 31 O)
    - 50 liaisons
  - *Joint Advisory Group (JAG)*
  - *Programme Maintenance Group (PMG)*
  - *Terminology Maintenance Group (TMG)*
  - *Harmonized Model Maintenance Group (HMMG)*
  - *XML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

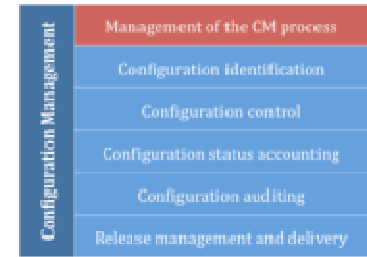
# Management of the process



- 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

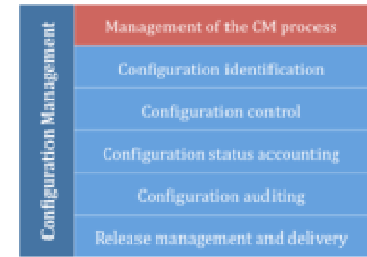


# Management of the process



- 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*

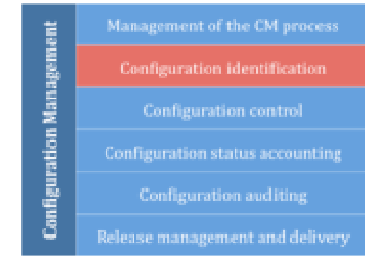
# Configuration identification

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

Identifies items to be controlled, identification schemes, versions, tools, techniques

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

# Configuration identification

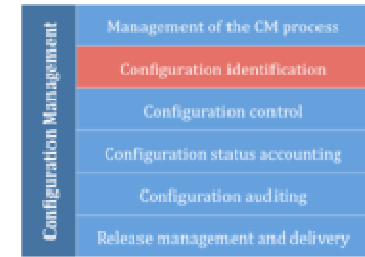


- Standard A uses a single type T defined in Standard B
- Standard A may or may not have a normative reference to Standard B
- Standard B is revised into B'
- Is Standard A still harmonized with Standard B'?

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

# Concept of a modular standard Configuration identification

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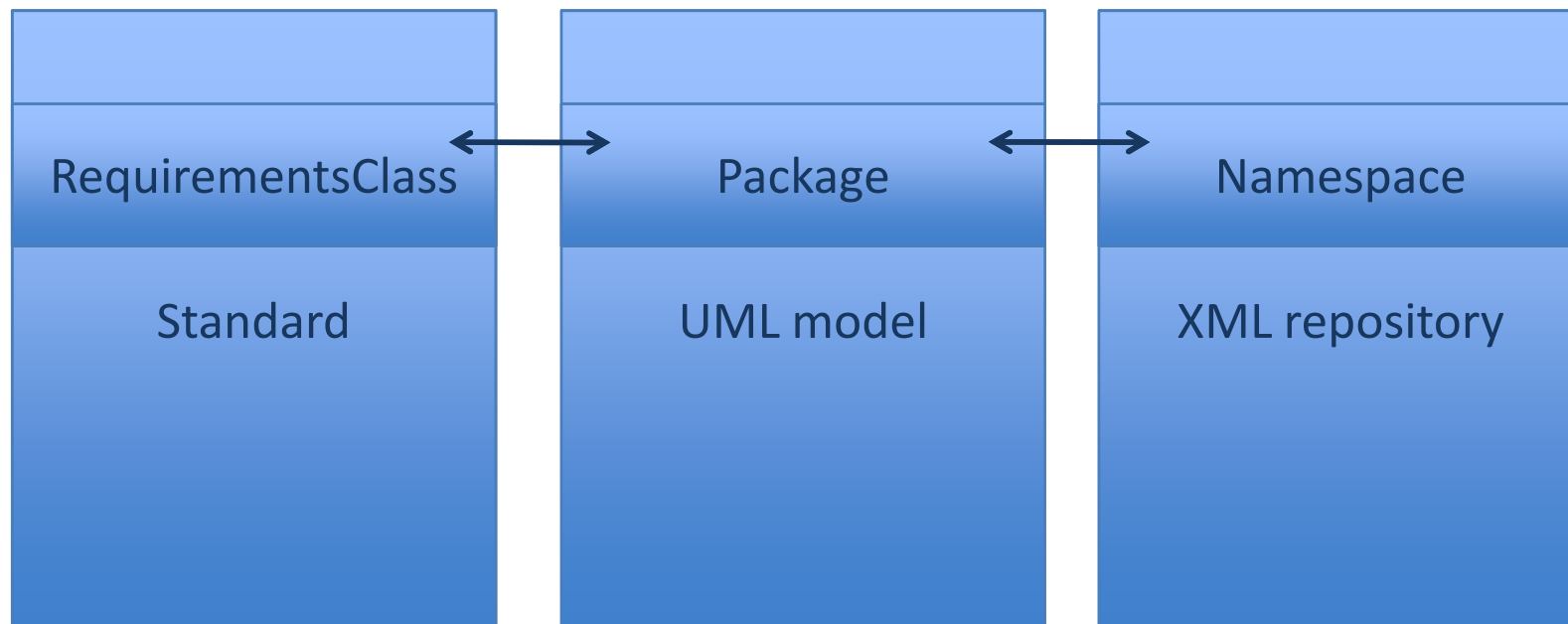


OGC, 2009

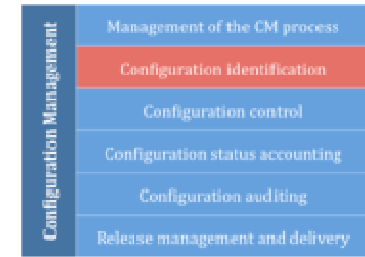
# Configuration identification

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

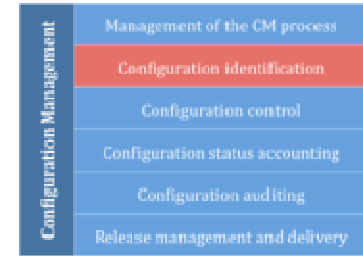


# Configuration identification



- 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](http://www.iso.org)
  - Nationally adopted standards through member bodies
  - Joint publications on the OGC website



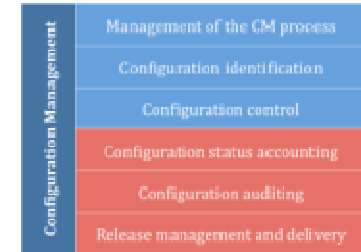
# Configuration control

Configuration Management	Management of the CM process
	Configuration identification
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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

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- 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

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

# Future

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- 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

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- 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

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- Contributions to the work on standard maintenance and configuration
  - ISO/TC 211 members
  - ISO/TC 211 Programme Maintenance Group (PMG)
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# Thank you

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