

STRICT AND AUTOMATIC MAPPING OF IFC-BIM MODELS INTO SEMANTICALLY ENRICHED 3D CITYGML BUILDING MODELS (EXTERIOR AND INTERIOR)

1ST INTERNATIONAL IAG WORKSHOP ON BIM AND GIS INTEGRATION

25 OCTOBER 2017

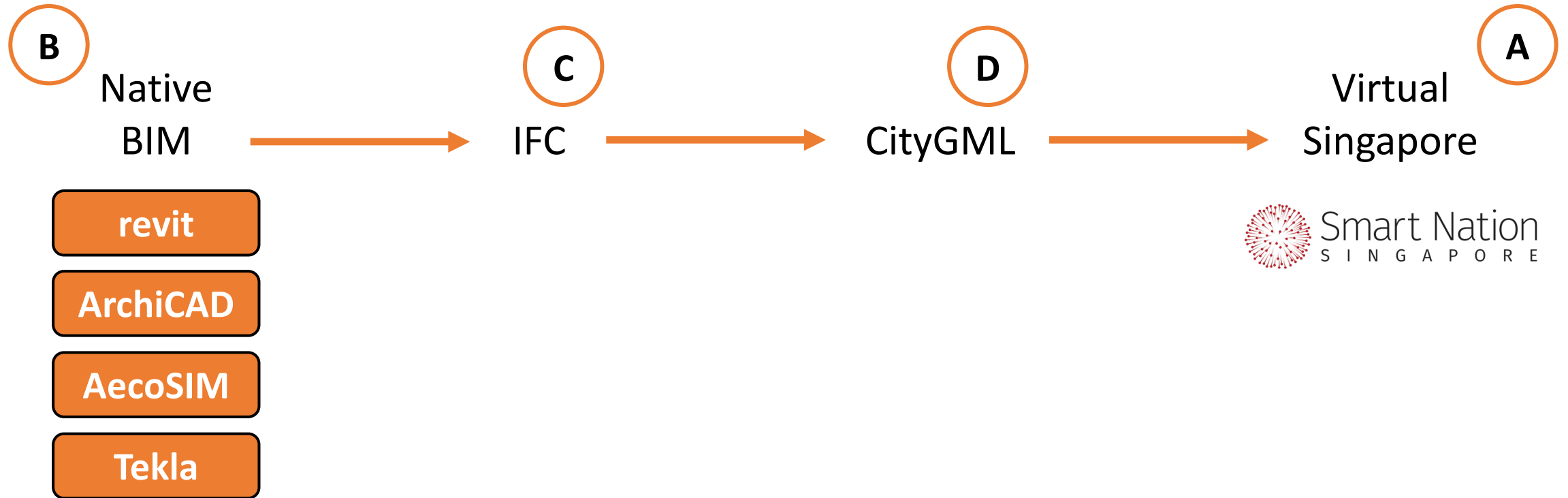
Rudi Stouffs



IFC TO CITYGML

- Challenges
- Approach
- Scope
- Use cases

CONVERSION PROCESS



A: VIRTUAL SINGAPORE CITYGML MODEL

- Virtual Singapore is a dynamic 3D city model and collaborative data platform. The model and platform will be unveiled during the World Cities Summit in July 2018.



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Challenge 1: Ensure the research is driven by user needs

A': POTENTIAL USE CASES



- Housing & Development Board (Centre of Building Research)
 - energy
 - urban greening
 - living environment
 - waste & water
 - building technology



- Urban Redevelopment Authority
 - housing
 - transport
 - economy
 - recreation
 - identity
 - public space



- Singapore Land Authority
 - 3D cadastre & strata
 - planning
 - operations
 - risk management

A': POTENTIAL USE CASES

- Simulations
 - thermal comfort (cool walls)
 - energy consumption (common lighting, elevators)
 - safeguarding wind corridors
 - limiting noise
 - solar photovoltaics
 - greening
 - rainwater harvesting and recycling
 - urban mobility
- Code compliance
 - privacy
 - view
- Visualisation
 - operations (e.g., refuse disposal)

Challenge 1: Ensure the research is driven by user needs

B: NATIVE BIM BUILDING MODELS

- Singapore's Building and Construction Authority (BCA) will mandate e-submissions in native BIM format for new developments with GFA more than 5,000 m². Native BIM e-submissions **must be prepared in accordance with the prevailing CoP.**

Types	Voluntary	Mandatory
Architecture	19 October 2016	Second half of 2017
C&S Engineering	1 October 2017	Second half of 2018
MEP Engineering	1 October 2017	Second half of 2018

Challenge 2: Work with real-world native BIM models

C: IFC4

- IFC4 Addendum 2 published on 15th July 2016
- Selection of IFC4 as state-of-the-art IFC standard
 - native BIM models as input
 - focus on architectural building data – including foundation (piling)



Challenge 3: Demonstrate the conversion of more information than has been previously achieved – to enable automatic creation of semantically enriched data models

D: CITYGML v3.0

- CityGML v3.0 is an ongoing development

- Core Model
- Level of Detail (LOD) concept
- improved interoperability with other relevant standards (IndoorGML, IFC, LADM)



- Application Domain Extension (ADE)

- GeoBIM (IFC) ADE for integrating semantic IFC data in CityGML is insufficient for our purpose

Challenge 4: Transition from CityGML v2.0 to CityGML v3.0 at some time during the project

CONVERSION PROCESS



1: FROM NATIVE BIM TO IFC4

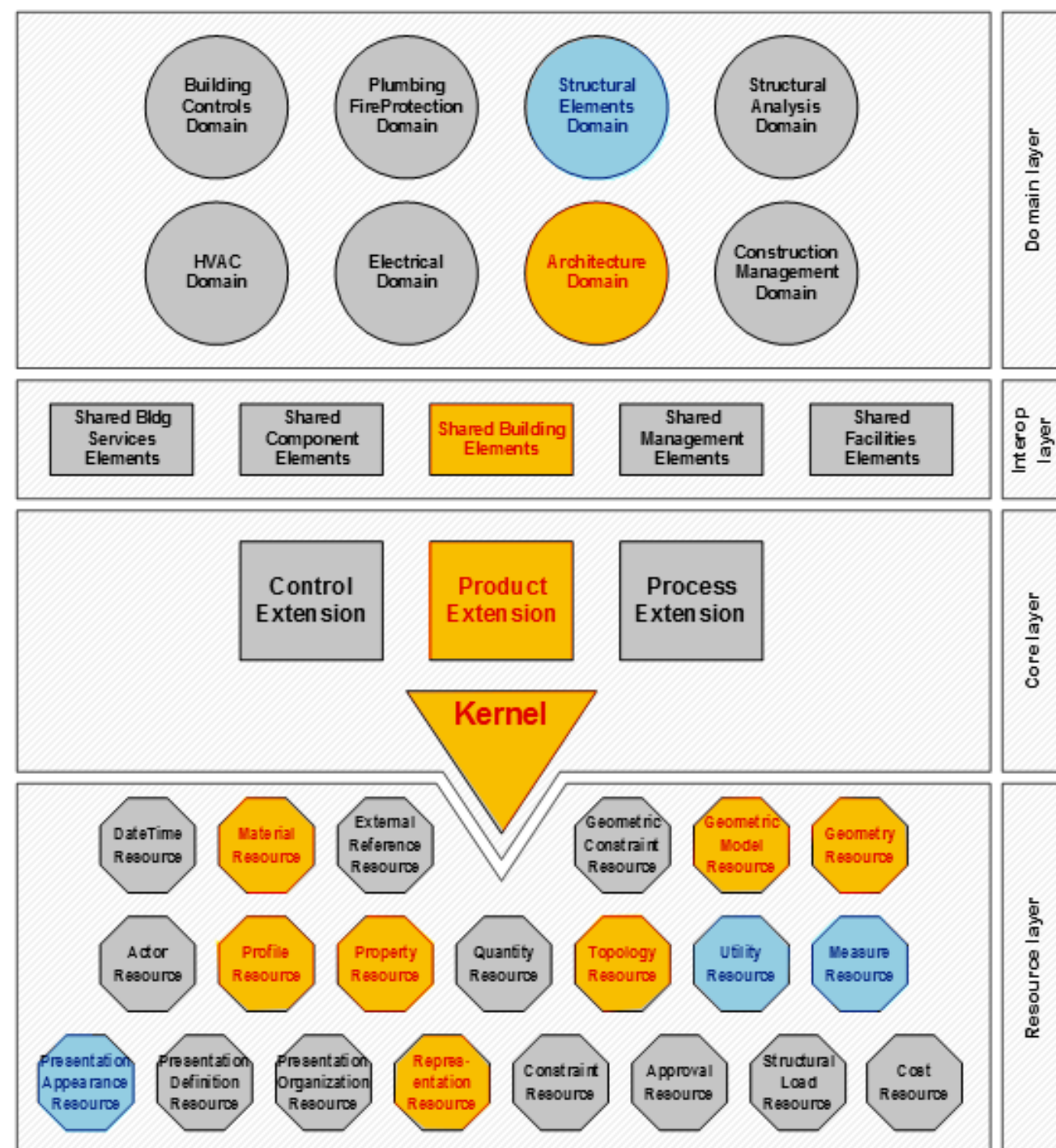
- Model consistency
 - no initial weeding of unfavourable BIM models – aim to determine workarounds for modelling **inconsistencies**
 - use of and tweaking of existing **export facilities** to ensure inclusion of all required information
- Model checking
 - can a **Model View Definition** (MVD) be used to ensure consistency?
- Model guidelines
 - suggestions for amendments to BIM e-submission **Code of Practice**, based on enhanced practical understanding of BIM-IFC-CityGML interoperability levels

2A: FROM IFC TO CITYGML – SCOPE

- Starting points
 - IFC4
 - buildings – architectural information (including foundation)
 - CityGML LOD3
 - exterior and interior (LOD4)
- Specification range
 - min: conversion of geometric model content
 - max: complete and lossless
 - use cases based
 - configurable?

2B: FROM IFC TO CITYGML

- Kernel
- Core layer
 - product extension
- Interop layer
 - shared bldg elements (wall, column, slab, stair etc.)
- Domain layer
 - architecture domain (windows and doors)
 - structural elements (piles and footings)
- Resource layer
 - to be derived from core and domain layer what is needed to support



2B: FROM IFC TO CITYGML

- Conversion of geometric content
 - SweptSolid, Brep, CSG, ...
- Type propagation from building elements to surfaces
 - walls, roofs, slabs, columns, beams, doors, windows
- Conceptual objects supporting informational use cases
 - spaces (physical and logical)
- Semantic relations supporting simulation use cases
 - window in a wall, ...
 - relationship between spaces and boundaries (CityGML v3.0)
- Relevant properties to support use cases
 - material properties: shader, reflectivity, transmittance, roughness
 - intended usage of spaces
 - ...

REMAINING POINTS

- From IFC to CityGML
- Theoretical framework

PROJECT DETAILS

- Project duration:
May 2017 – April 2019
- Funding: NRF2015VSG-AA3DCM001-008
NRF and GovTech

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- Research collaboration:
OSI



- Collaborating agencies:
HDB, BCA, URA



To make Singapore a great city to live, work and play



- Collaborating vendors:
Bentley, Graphisoft, Trimble, Autodesk



RESEARCH TEAM

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THANK YOU

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