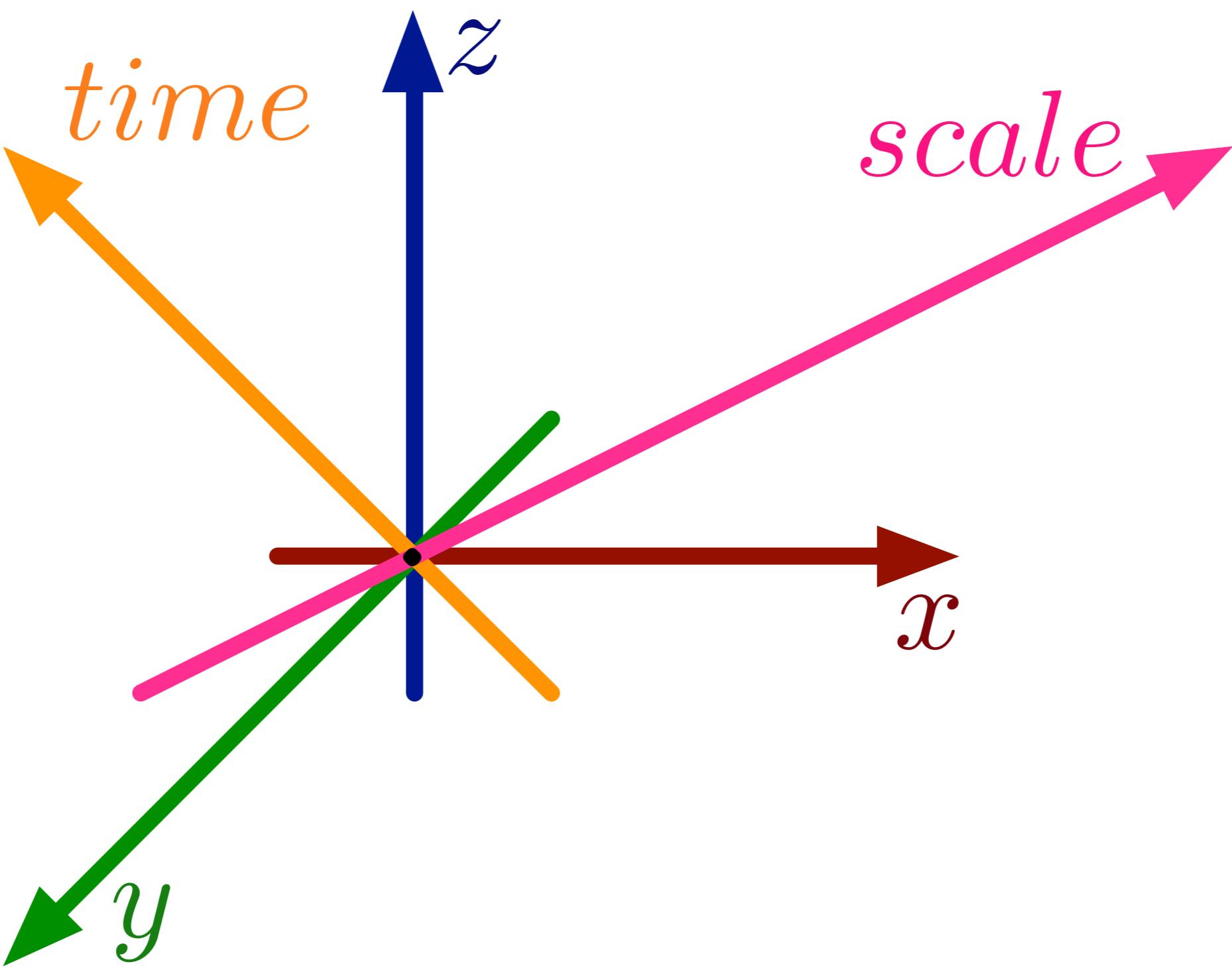


Storing a 3D City Model, its Levels of Detail and the Correspondences between Objects as a 4D Combinatorial Map

Ken Arroyo Ohori, Hugo Ledoux and Jantien Stoter
ISPRS WG II/2 Workshop
October 28, 2015

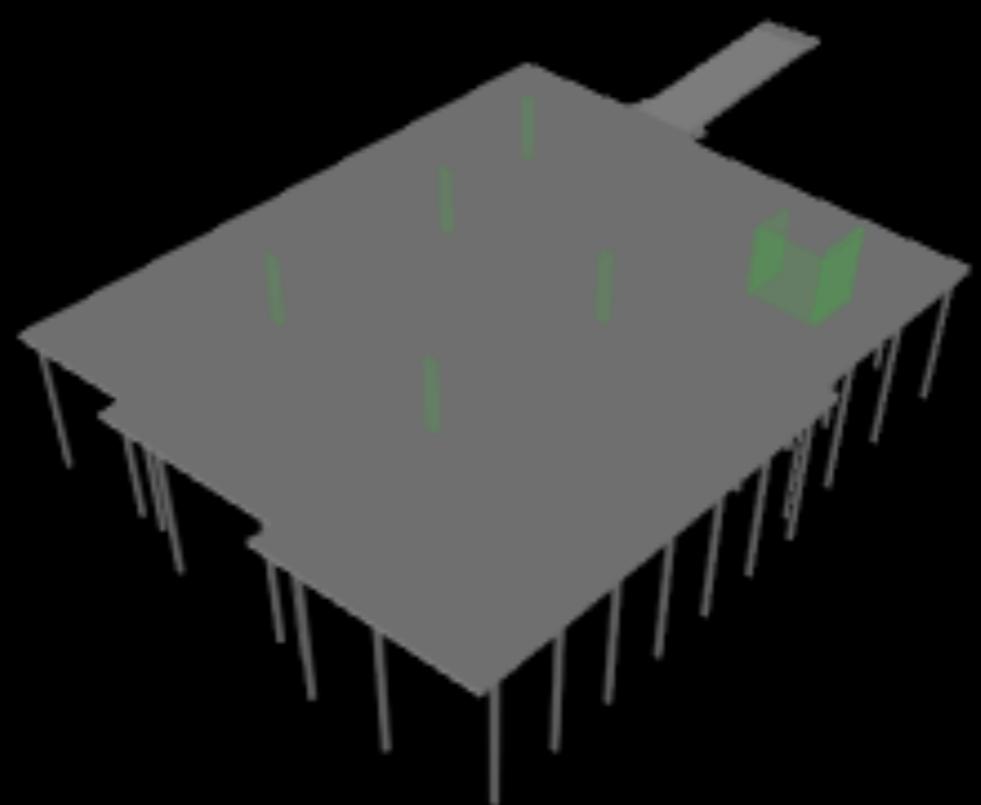
Motivation

nD integration

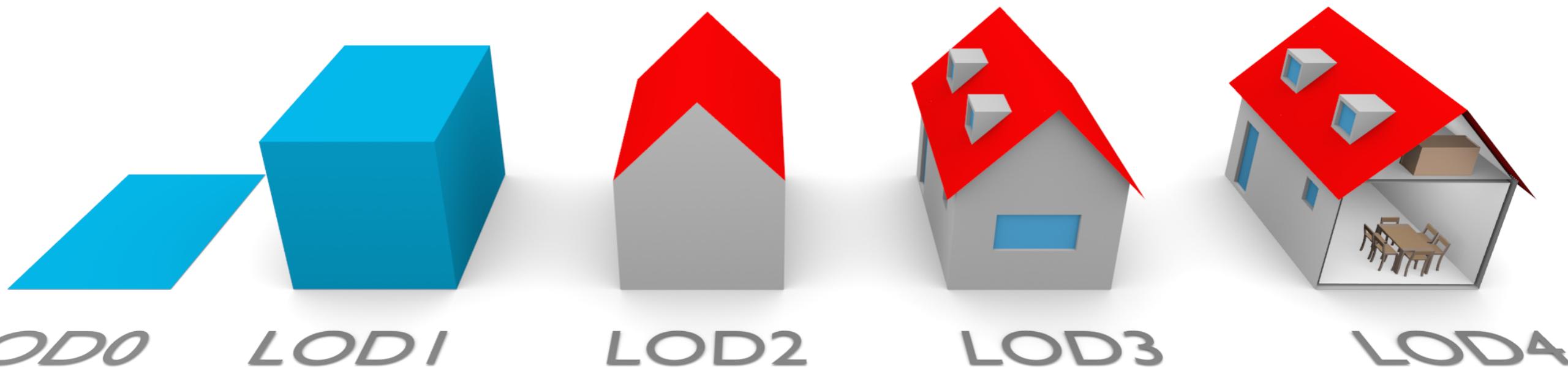


3D+time

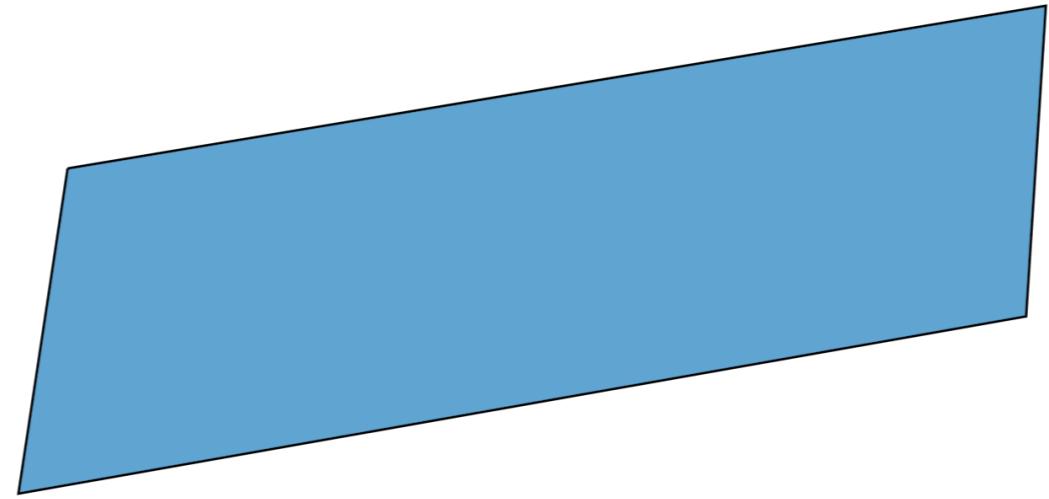
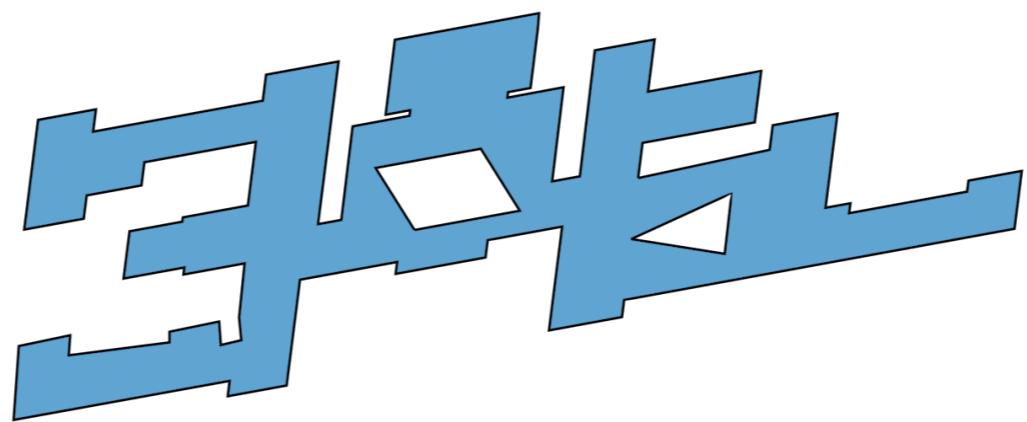
zaterdag 11:02:24 4-9-2010 Day=18 Week=3



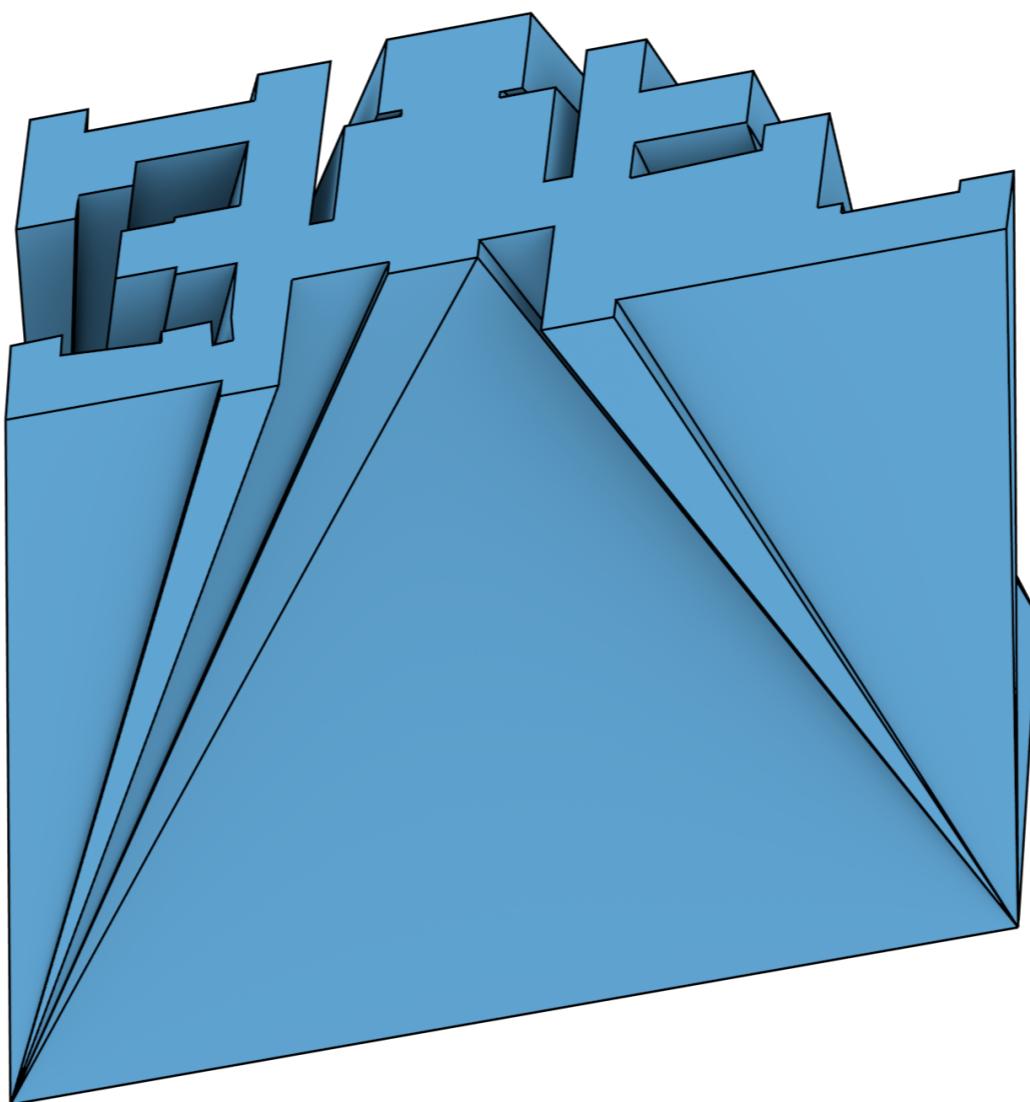
Here: 3D+scale



Aim



Aim

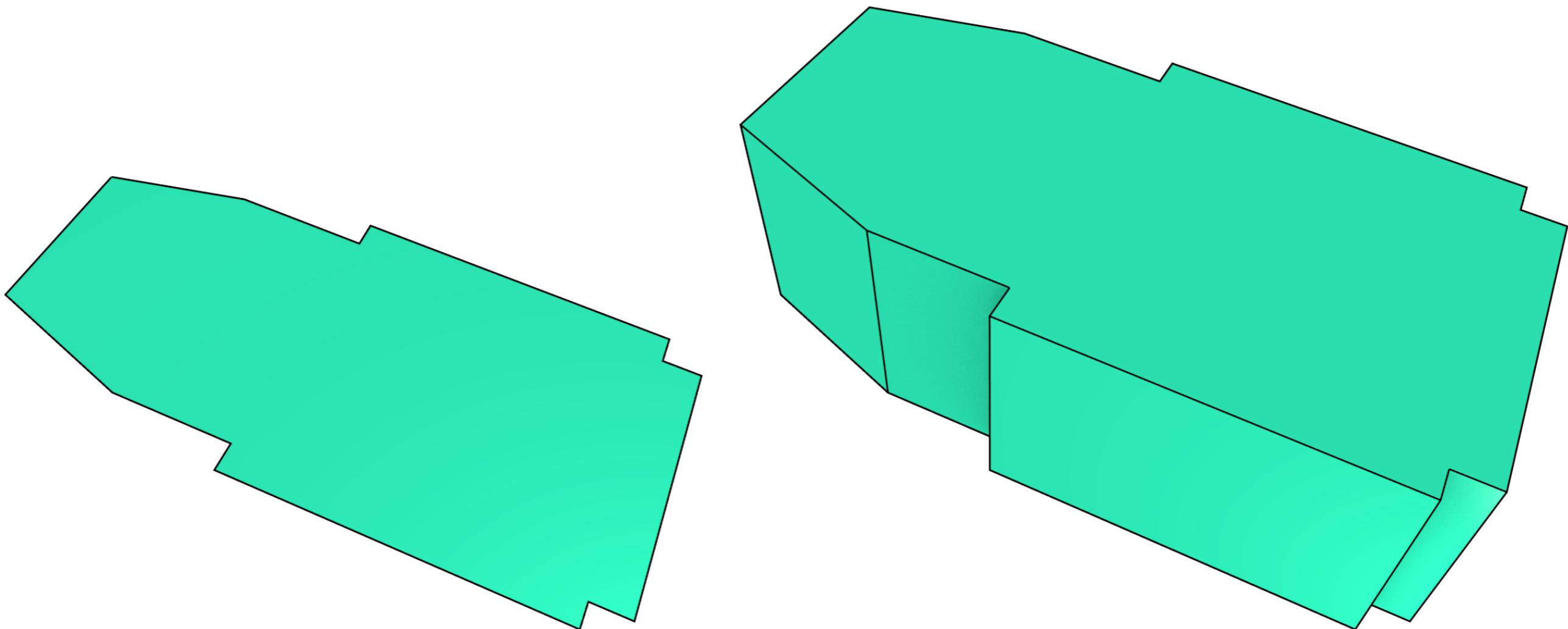


Advantages

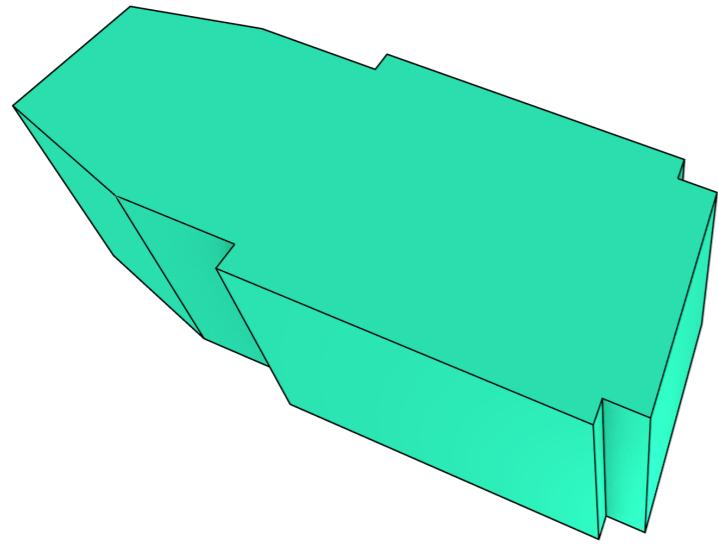
- Forming a clean 4D topological space partition
- Storing relationships between any group of related objects, of any dimension
- Attaching semantic information to objects of any dimension or to the relationships between them

Examples: simple nD
operations

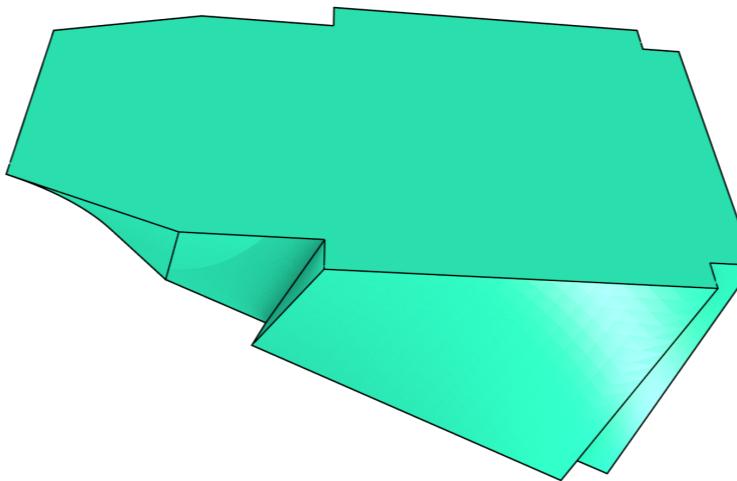
Extrusion: no change



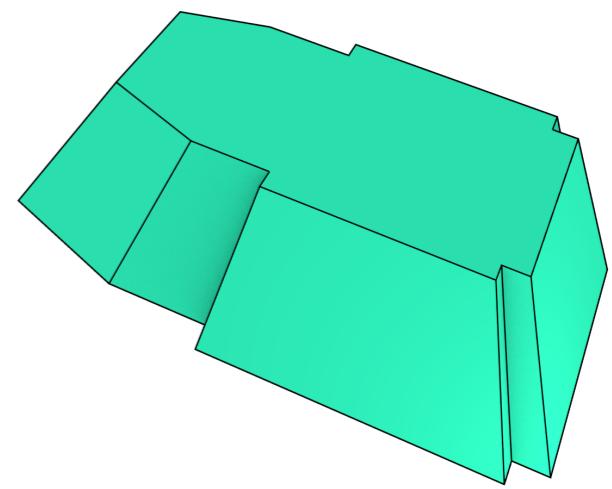
Transformations



Translation

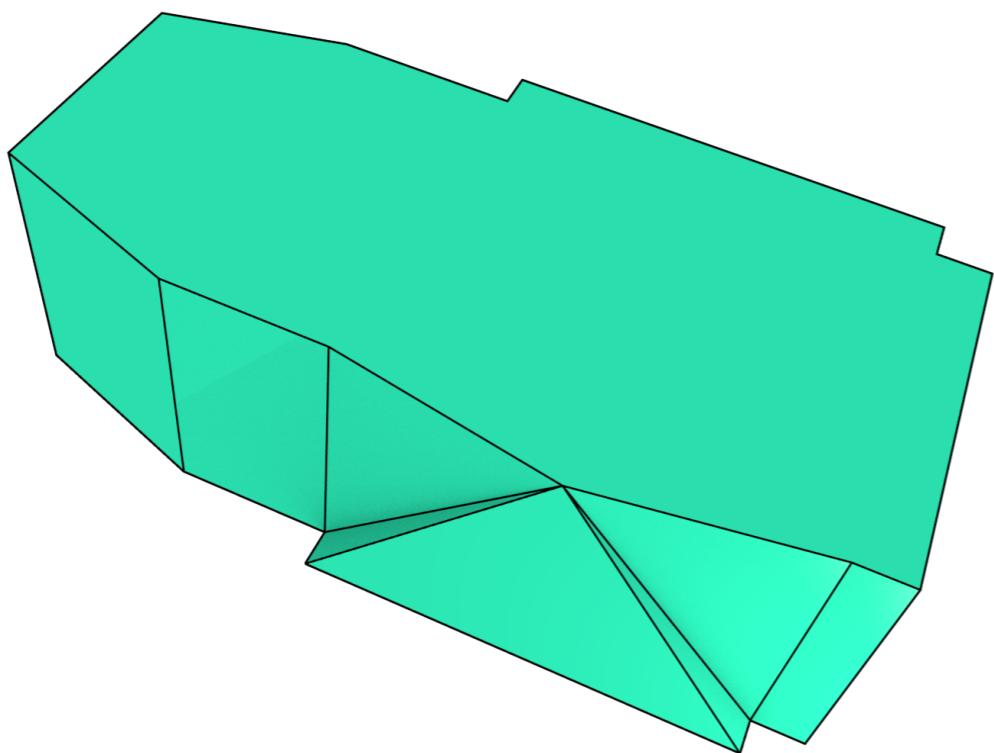


Rotation

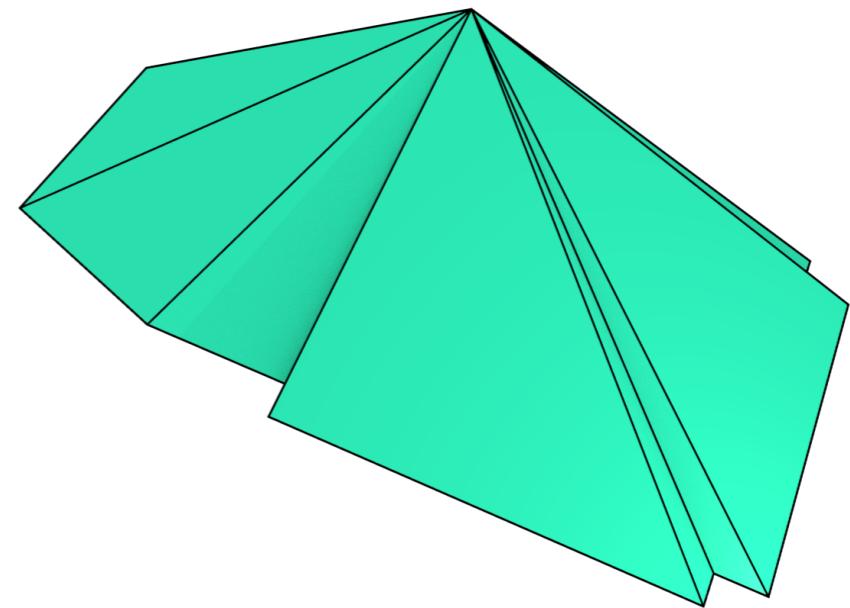


Scale

Collapse

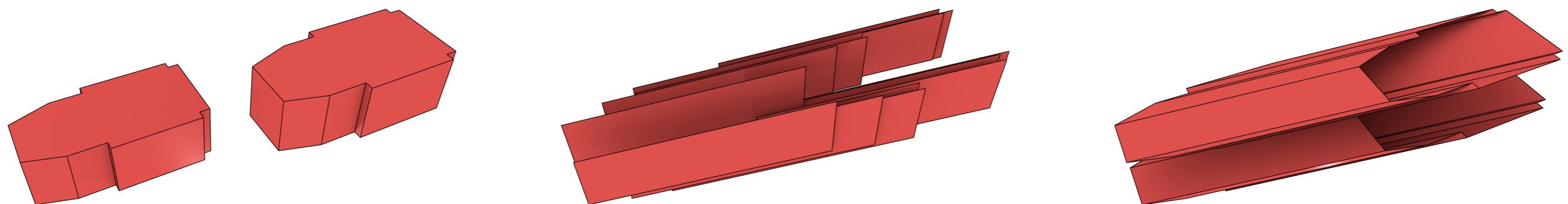


Edge



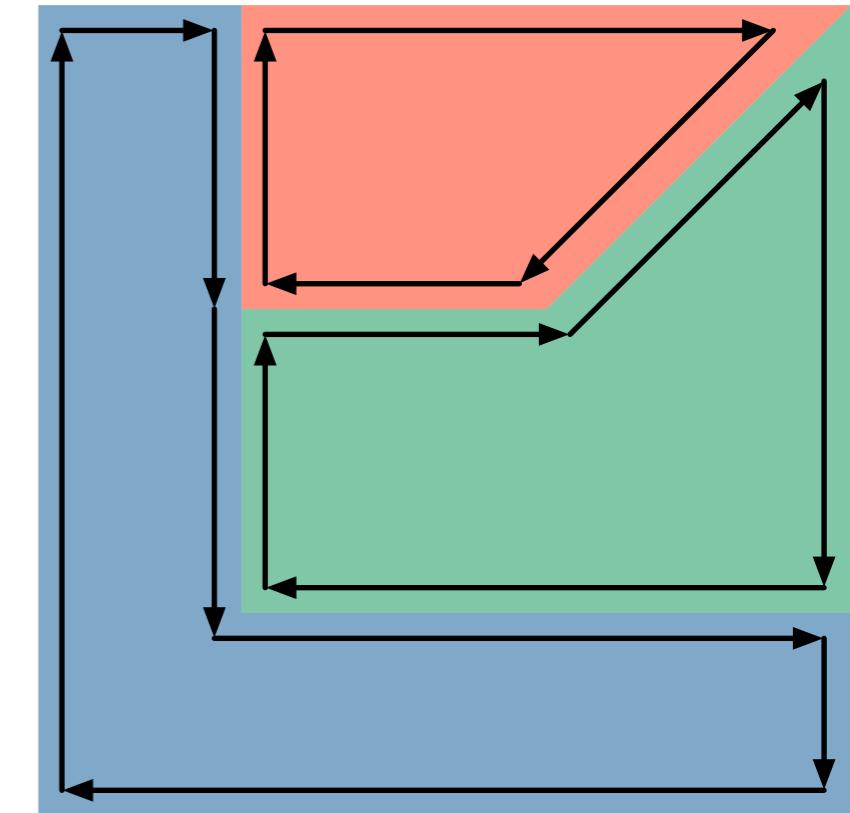
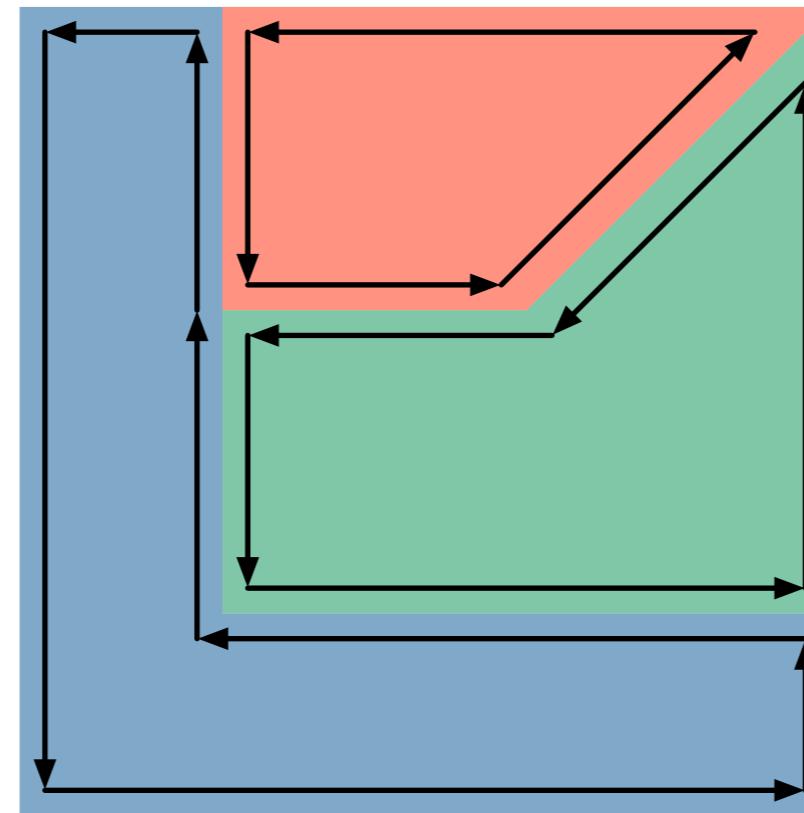
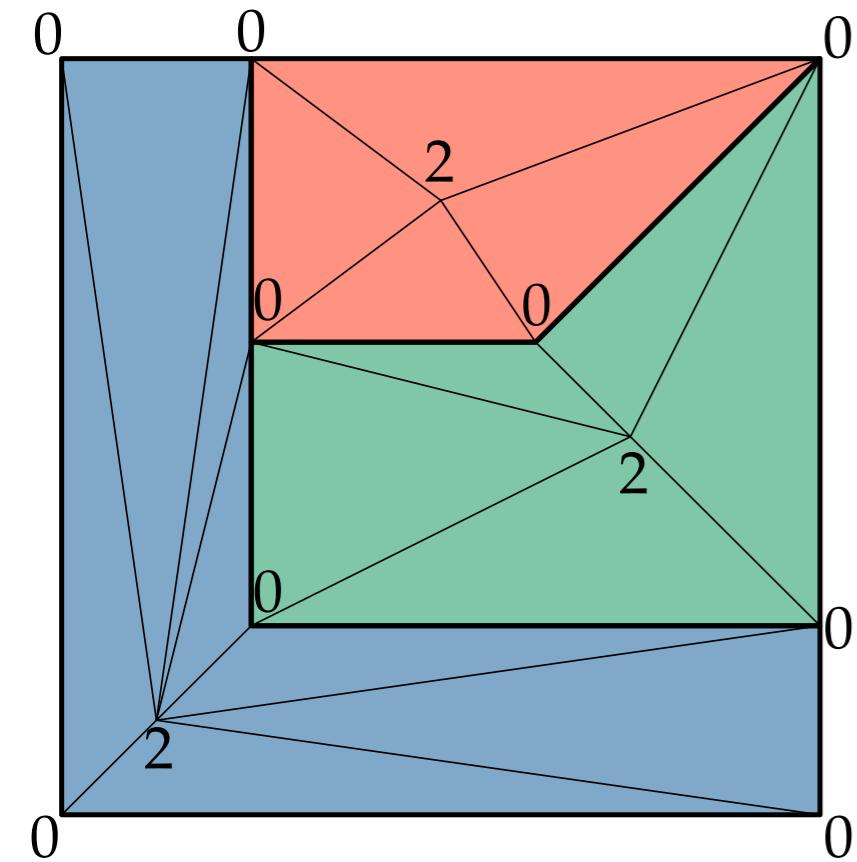
Face

4D example

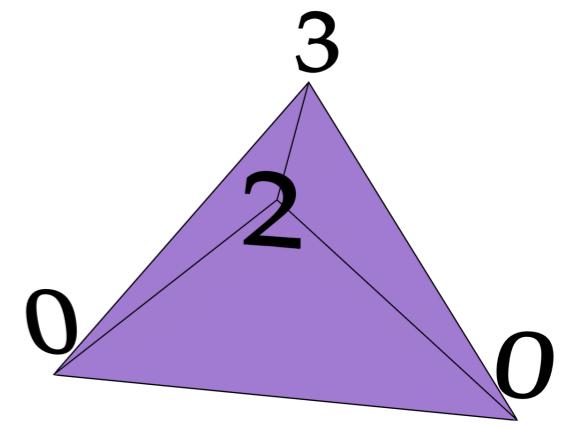
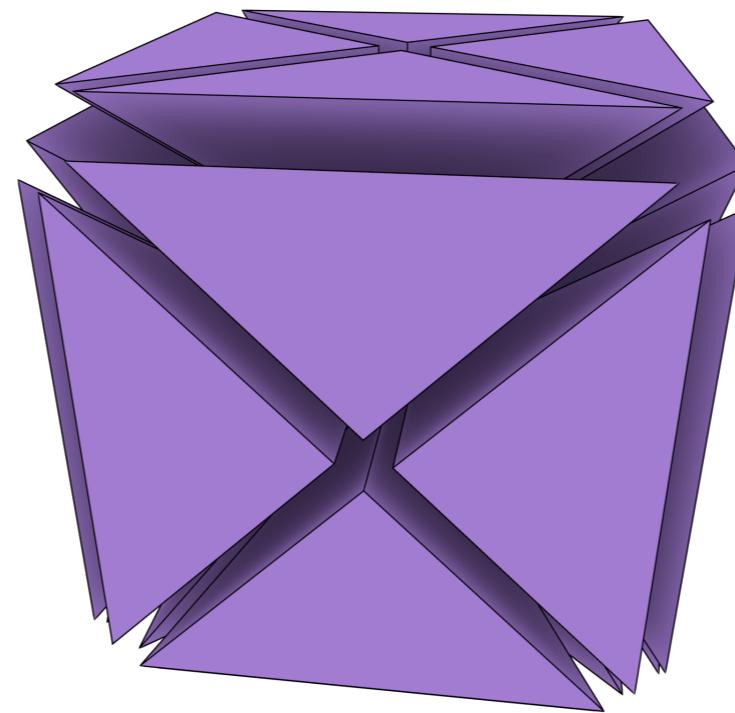
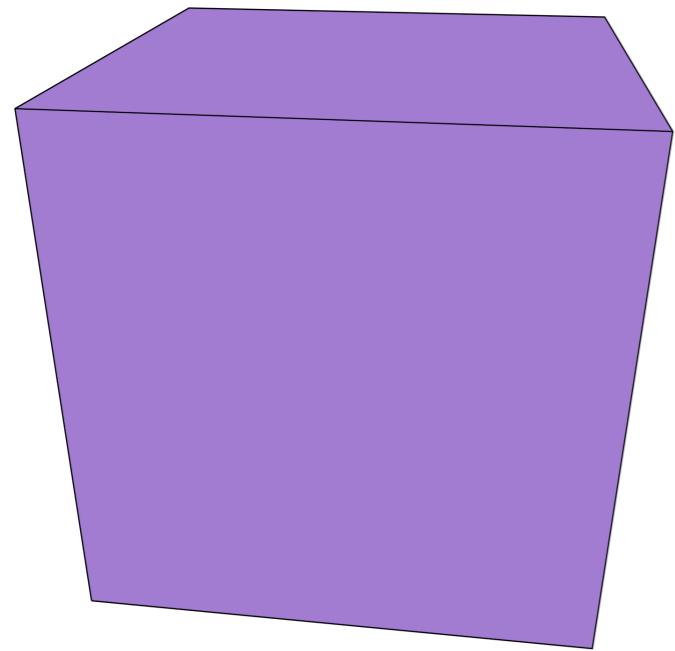


Storage as
combinatorial maps

2D combinatorial maps



3D combinatorial maps



```

typedef typename Refs::size_type size_type;
static const size_type NB_MARKS = Refs::NB_MARKS;
int id;

Dart_with_id() : Dart() {
    id = -1;
}

Dart_with_id(int id) : Dart() {
    this->id = id;
}

Dart_with_id(const Dart& adart) : Dart(adart) {
    id = -1;
}
};

template <unsigned int d>
struct Linear_cell_complex_items_with_id {
    template <class LCC>
    struct Dart_wrapper {
        typedef CGAL::Cell_attribute_with_point<LCC, int> Point_attribute_with_id;
        typedef CGAL::Cell_attribute<LCC, int> Attribute_with_id;

        template <unsigned int attributes_to_add, class Result = CGAL::cpp11::tuple<> >
        struct Linear_cell_complex_items_with_id_attributes;

        template <class ... Result>
        struct Linear_cell_complex_items_with_id_attributes<0, CGAL::cpp11::tuple<Result ...> > {
            typedef CGAL::cpp11::tuple<Point_attribute_with_id, Result ...> tuple;
        };

        template <unsigned int attributes_to_add, class ... Result>
        struct Linear_cell_complex_items_with_id_attributes<attributes_to_add, CGAL::cpp11::tuple<Result ...> >
            typedef typename Linear_cell_complex_items_with_id_attributes<attributes_to_add-1,
                CGAL::cpp11::tuple<Attribute_with_id, Result ...> >::tuple tuple;
    };
};

typedef Dart_with_id<d, LCC> Dart;
typedef typename Linear_cell_complex_items_with_id_attributes<d>::tuple Attributes;
};
};

```

Implementation: CGAL

Read more

- **Storing a 3D city model, its levels of detail and the correspondences between objects as a 4D combinatorial map.** Ken Arroyo Ohori, Hugo Ledoux and Jantien Stoter. *Proceedings of the ISPRS WG II/2 Workshop*, October 2015.
- **Modelling a 3D city model and its levels of detail as a true 4D model.** Ken Arroyo Ohori, Hugo Ledoux, Filip Biljecki and Jantien Stoter. *ISPRS International Journal of Geo-Information* 4(3), September 2015, pp. 1055–1075. ISSN: 2220–9964.

Thank you!

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