Understanding the BIM in NBIMS

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Formal Definitions Of BIM

- **Wikipedia: The Building Information Model (BIM) is a set of *information* generated and maintained throughout the lifecycle of a building. Building Information Modeling (BIM) is the process of generating and managing a building information model.**
- **NBIMS: BIM is [intended to be] an open standards based *repository* of information for the facility owner/operator to use and maintain throughout the life-cycle of a facility.**
- **IAI Nordic Chapter: BIM is an object-oriented, AEC-specific … digital representation of a building to facilitate *[data] exchange* and interoperability of information *in digital format* (Kiviniemi et al., 2007).**

BIM Handbook (Eastman et al. 2008)

BIM is a modeling technology and associated set of processes to produce, communicate, and analyze *building models* … characterized by

- **Building components that are represented with intelligent digital representations … and can be associated with computable … attributes and parametric rules.**
- **Components that include data that describe how they behave …**
- **Consistent and non-redundant data …**
- **Coordinated data such that all views of the model are represented in a coordinated way.**

BIM Handbook (Eastman et al. 2008)

What is *not* BIM technology

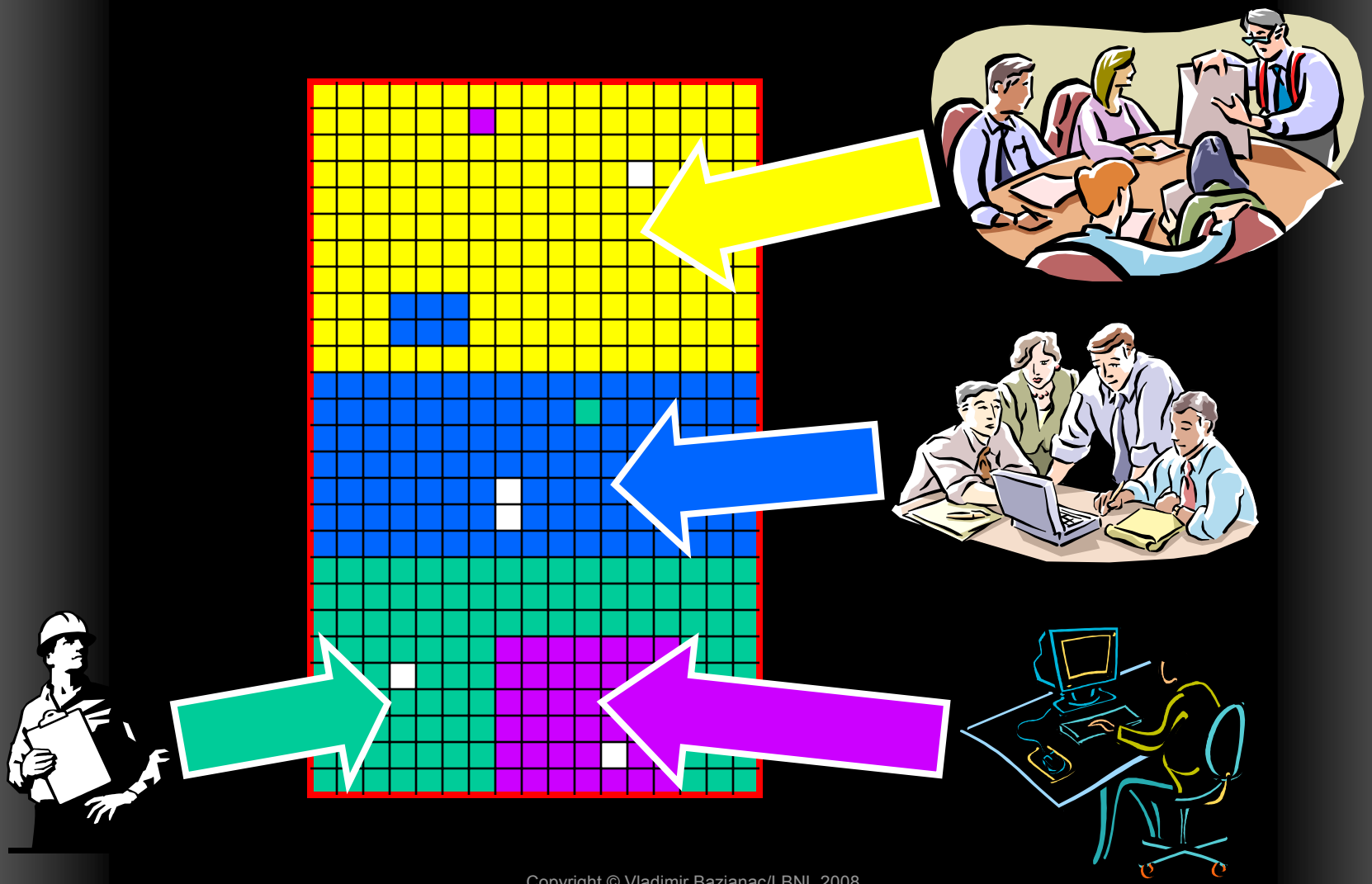
- Models that contain 3D data only and no object attributes.
- Models with no support of behavior [i.e. models that do not utilize parametric intelligence].
- Models that are composed of multiple 2D CAD reference files that must be combined to define the building.
- Models that allow changes … in one view that are not automatically reflected in other views.

Information Science Definitions

- As a *noun*: *B*uilding *I*nformation *M*odel
  - An *instance* of a *populated* data model of buildings that contains multi-disciplinary data specific to a particular building which they describe *unambiguously*
- As a *verb*: *B*uilding *I*nformation *M*odel*ing*
  - The *act/process* of *creating* a Building Information Model (BIM – a noun)
- Building information modeling is a *process* that requires the availability of
  - A *data model* of buildings
  - Information *about* a (specific) building
  - Software to *populate* the data model with that information

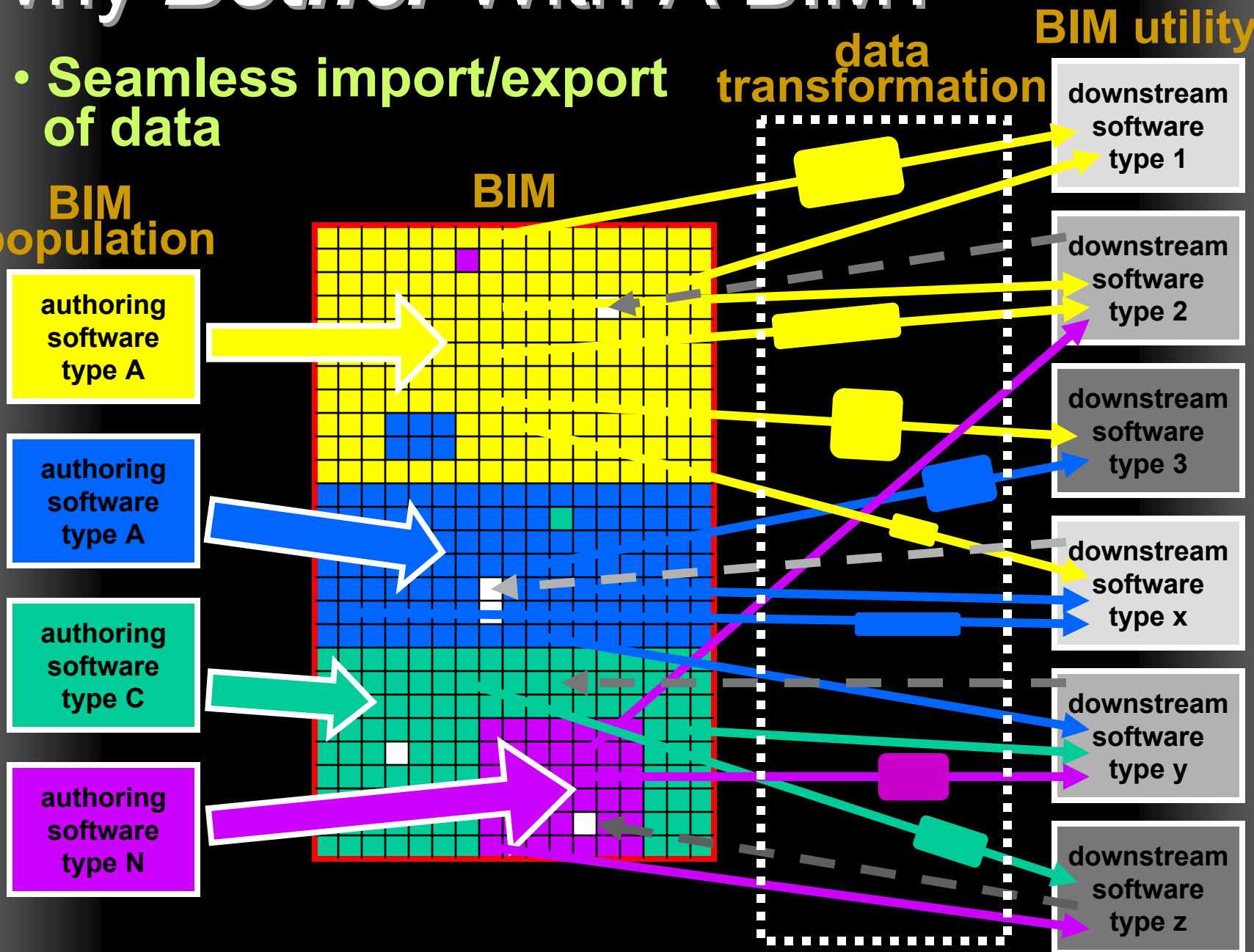
What ***Essentially*** Is A BIM?

- **Instance of a data model**
- **populated with data from a particular building**

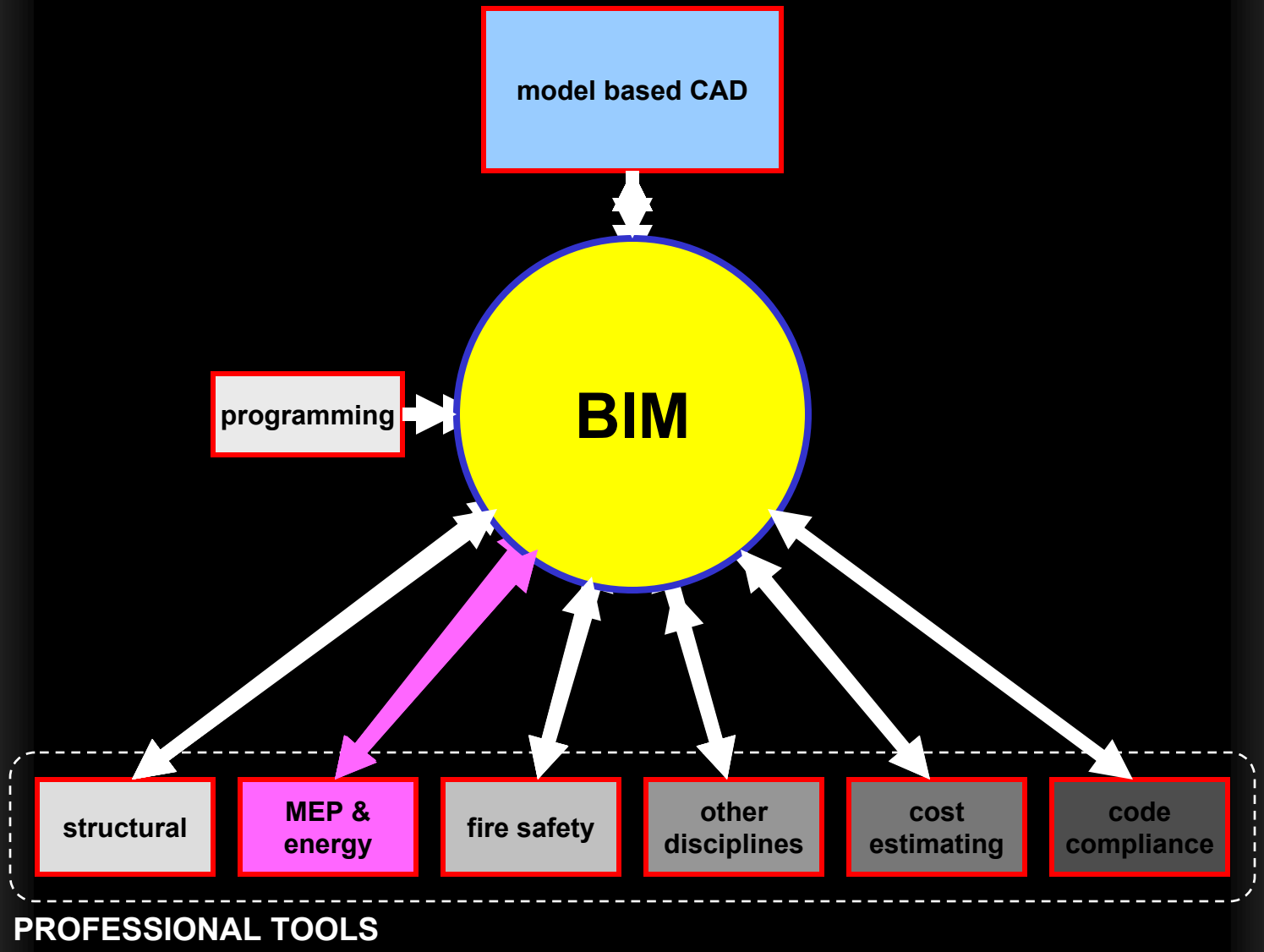


Why ***Bother*** With A BIM?

- **Seamless import/export of data**

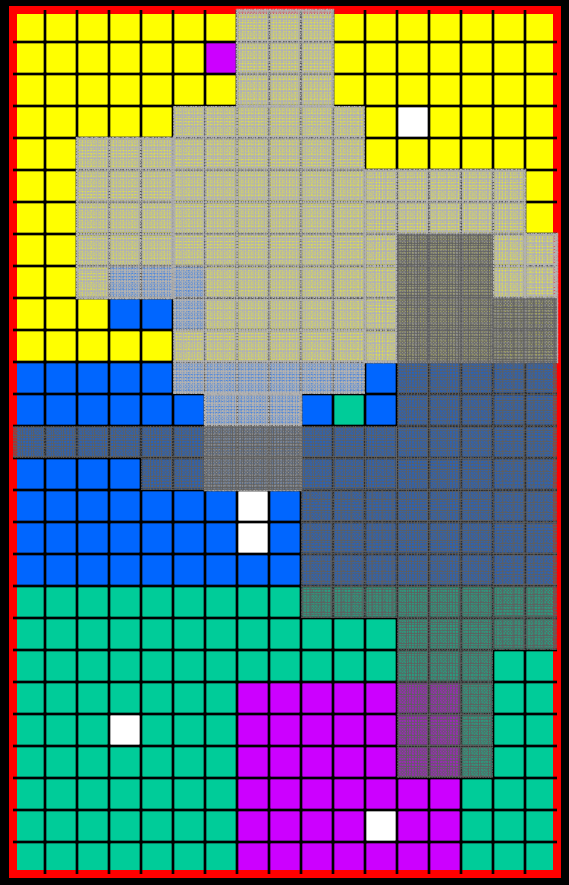


BIM & Professional Lifecycle Tools



Views Of Data Model

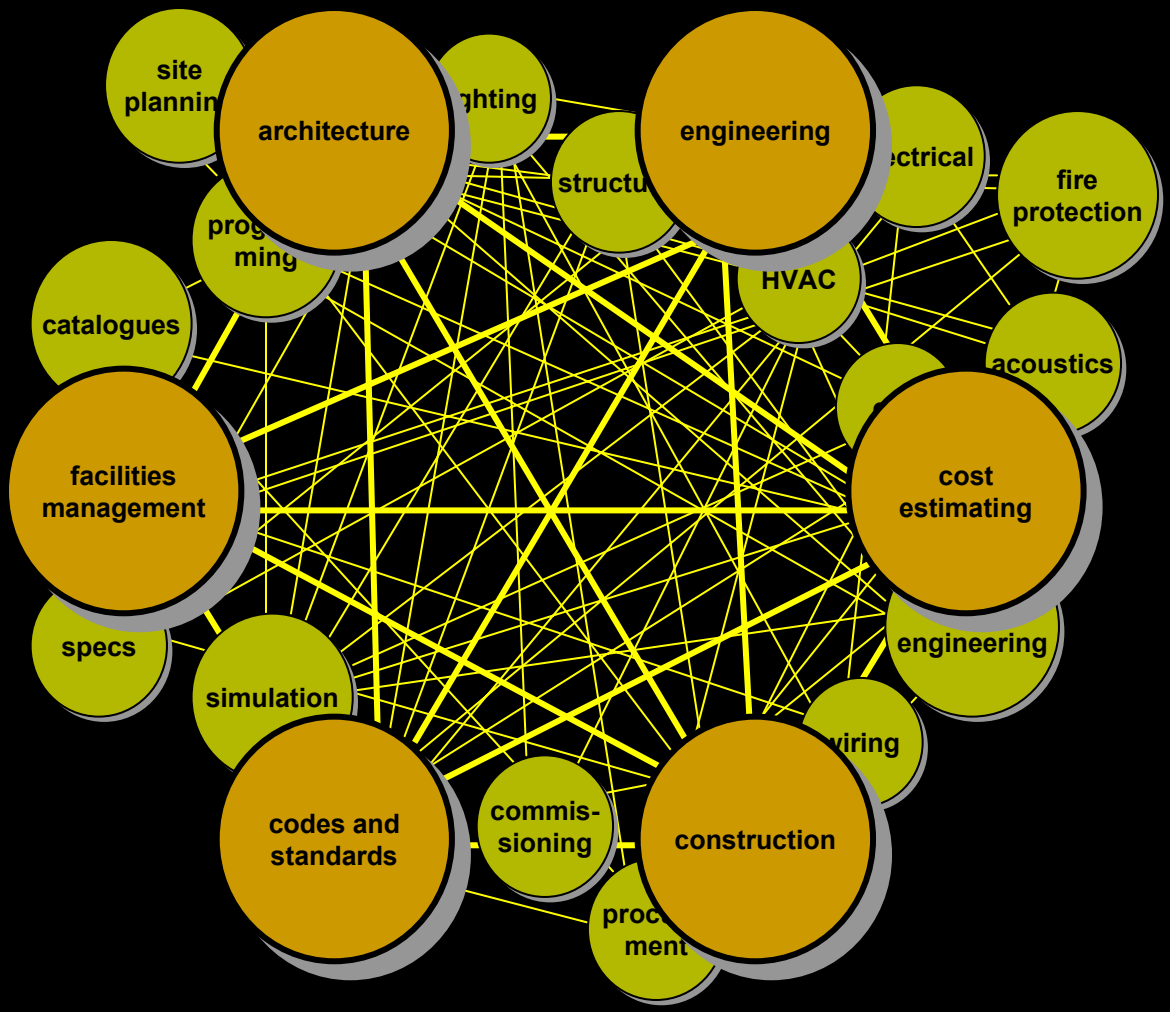
data model



model view x

model view y

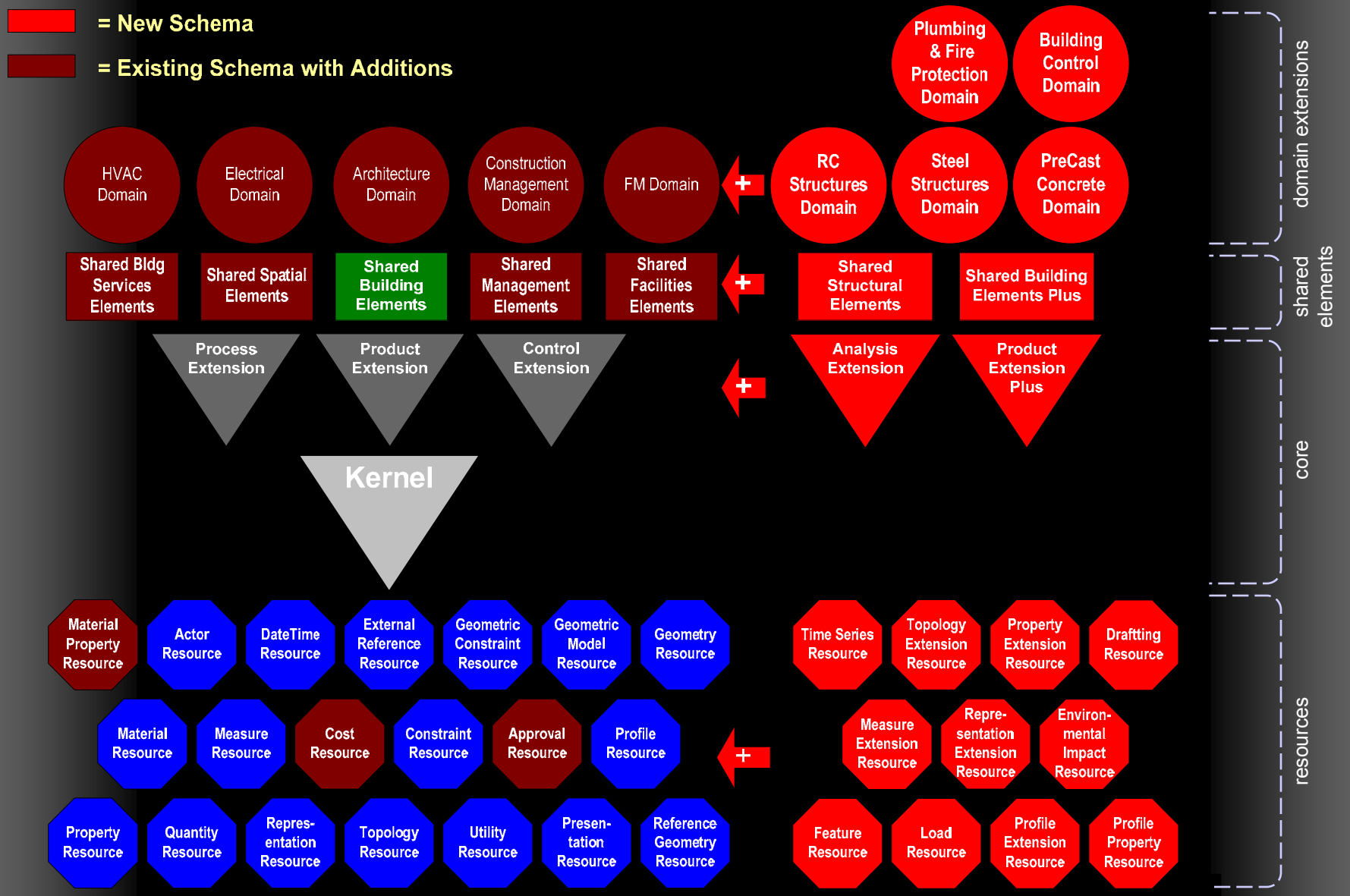
Current Data Exchange Practice



Data Models Of Buildings

- **Proprietary**
  - Serve as basis for *integrated* software tools
  - Typically *developed by* large (CAD) *vendors*
  - Accessible/extensible only by *authorization*
  - Typically define only *parts* of the building life cycle
  - Prime example: Autodesk Foundation Classes (AFC)
- **Open**
  - Freely *accessible and extensible*
  - Comprehensive, define the *entire life cycle of buildings*
  - The only example: *IFC* (ISO/PAS 16739 status)
- **Common characteristic/requirement**
  - Intelligent (i.e. object oriented)

IFC Model Architecture



What One Must Know

- About IFC (or any other data model of buildings)
  - End user: *nothing* – the data model should be totally *transparent*
  - Software interface developer: *everything*, particularly everything within the *implemented model view*

BIM Data Transformation

- **Import/export of data by "downstream" software almost always necessitates *transformation of data* (data set reduction/ simplification, data translation and interpretation)**
- **Arbitrary, ad-hoc, subjective and ill-informed data transformation are some of the main reasons why "downstream" simulation and analysis results are *unreliable* and *not* reproducible**
- **Firm transformation rules, embedded in model view definitions and in middleware, make results *reproducible***

Data Transformation Rules

- **Rules must be *unambiguous* and *uniformly* interpreted and implemented**
  - **Reproducible *regardless of software*: same original data, same result of transformation**
  - **Agreed upon by industry and software developers**
- **Rules must protect *integrity of data***
- **Rules embedded in code**
  - **No arbitrary manual intervention in data transformation allowed/possible**
  - **Embedded in model views**
  - **Embedded in middleware**

Types Of "BIM" Software

- All "BIM" software is model based
  - Intelligent (object oriented) *itself*, or
  - Has *interfaces* to object oriented data bases
- BIM authoring tools
  - Instantiate data model with *authoritative* (original) data that describe a building
  - Usually used in a logical, industry process based *sequence*
  - CAD software examples: Revit, MicroStation, ArchiCAD, Allplan, etc.
  - CAD software example that is *not* a BIM authoring tool: AutoCAD
- "Downstream" (lifecycle) applications
  - Software that *imports* data it needs to work from a (partially) populated BIM
  - Software used to support work of *different industry disciplines*
  - Often performs BIM authoring
- Model validation software
  - Solibri Model Checker (*SMC*), Univ. of Karlsruhe's *IFC Explorer*

Major BIM Population Issues

- **Data and model validation**
  - Entered data must be *meaningful* and *unambiguous*
  - BIM must be *"clean"*
- **Software must comply with model views**
  - Software must be capable of *populating all* data and data sets defined by the view(s) it serves (even if some views overlap)
- **Data integrity**
  - All data must come from their *original source*
  - Entered data must be reliable, persistent, consistent and not contradictory
- **Sequence in data and data set instantiation**
  - Given relationships and inheritances defined in the data model, some data and data sets *must* be defined before other (e.g., walls must be defined before windows)
- **Data ownership**
  - Must be defined in contracts and acceptable to all involved
- **BIM access authorization management**
  - Individual and group "write" permissions

Current Status Of "BIM" Software

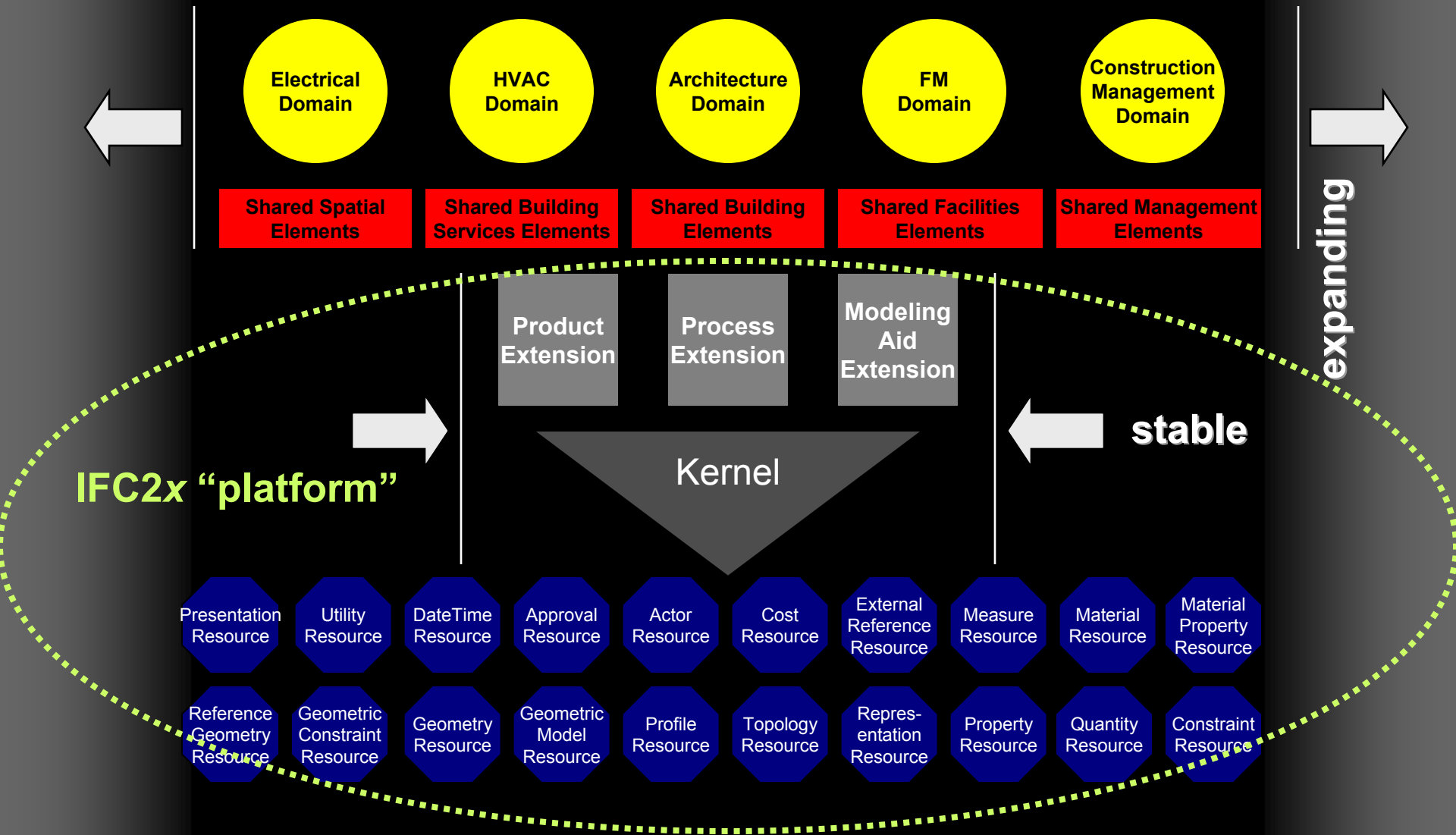
- **Most "BIM" software *currently* falls way short of *end users' expectations***
  - **Limited functionality**
  - **Immature state of development**
  - **Full of bugs**
  - **Not robust**
  - **Relies too much on (often arbitrary) approximation**
- **Most "downstream" (lifecycle) applications are *not* (yet) *interoperable***
- **Software *quality and lack of interoperability are critical bottlenecks* in AECOO industry wide adoption of BIM**
- **Weak AECOO industry software market does not justify the necessary increases in software development investment**

What Else One Must Know

- About "interoperable" software
  - What interoperable software can *perform the task*
  - With what *other* software can that software *exchange data*
  - How to use that software *competently* and *effectively*
  - That used data are *valid*
  - There is no substitute for knowledge and understanding – results from "black boxes" may *not* be what one might think they are
- About all of this
  - There are *no* shortcuts or "freebees" – you "get what you pay for"

IFC As ISO/PAS 16739

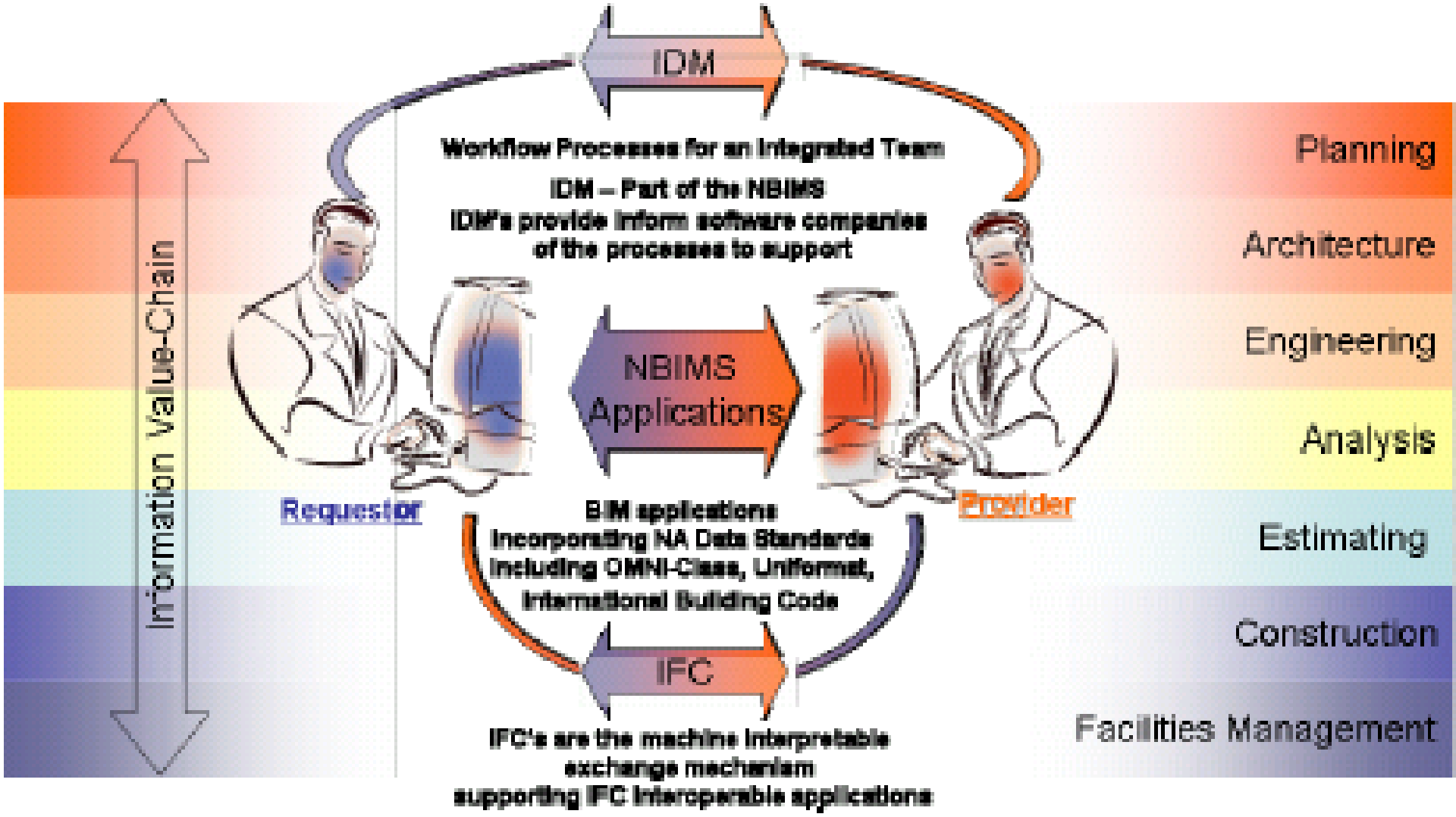
- Formal ISO standard (PAS) as of September 2005



What Is A National Standard?

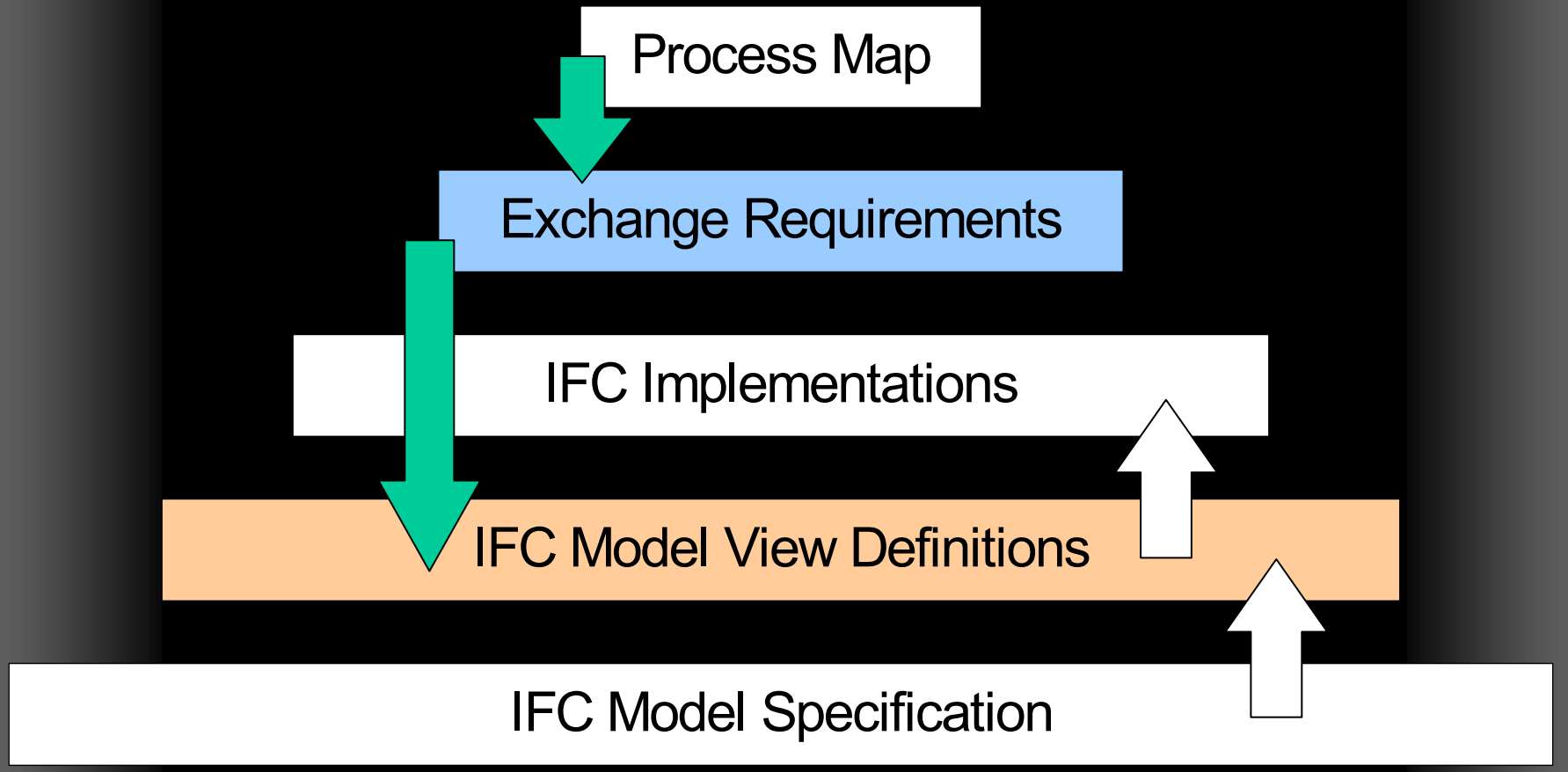
- Google: Technology-related convention as defined by a government or an industry standards body.
- Main elements of a national standard
  - Definition of standard
  - Acceptance of standard
  - Implementation of standard
  - Compliance with the standard
  - Enforcement of standard
- A standard supports a given policy and is its reflection
- Standard enforcement impacts the judiciary system

National BIM Standard Definition



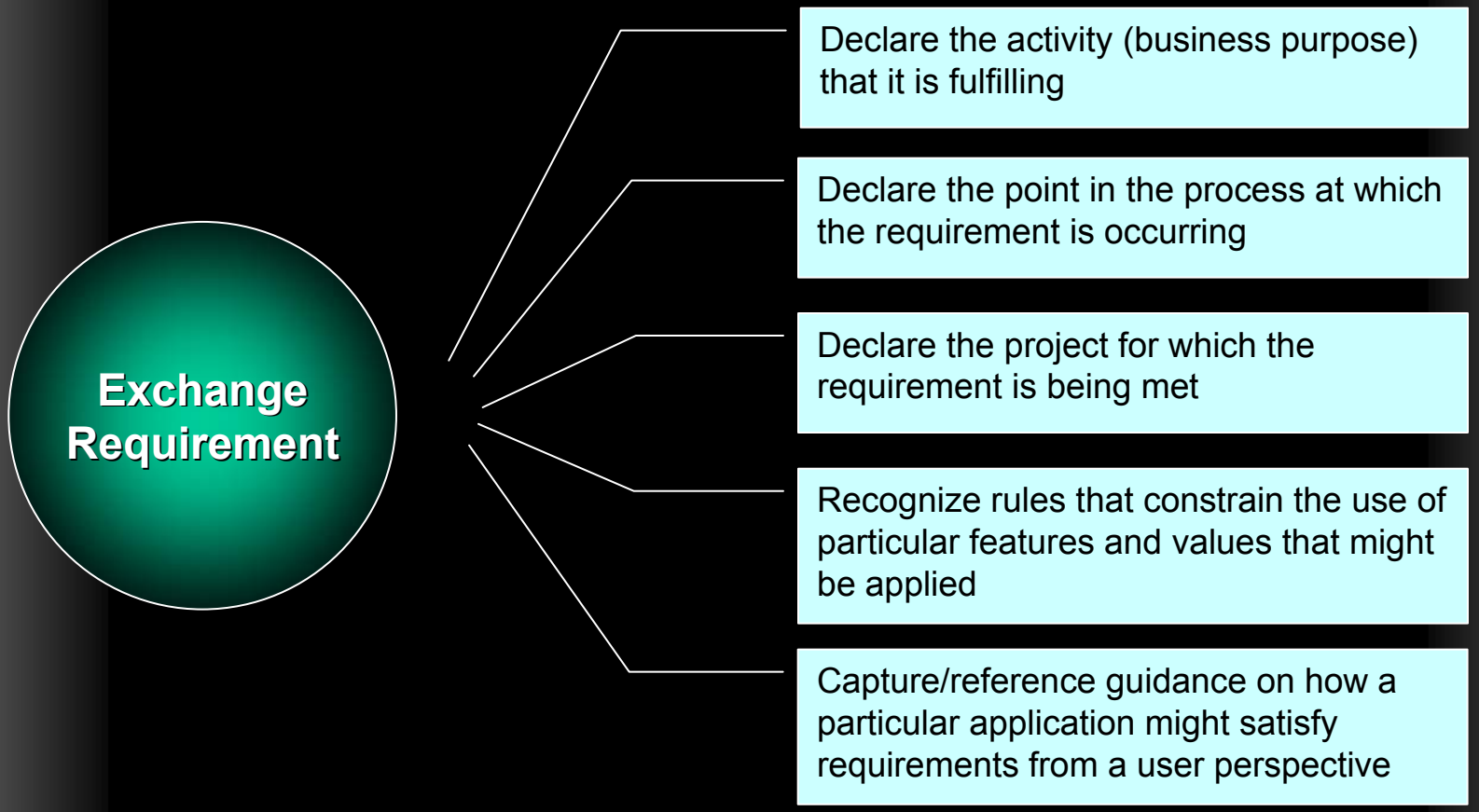
From NBIMS, version 1, part 1, p. 20

Creating IFC Based BIM Standard



By courtesy of Jiri Hietanen

Delivering Benefit for the User



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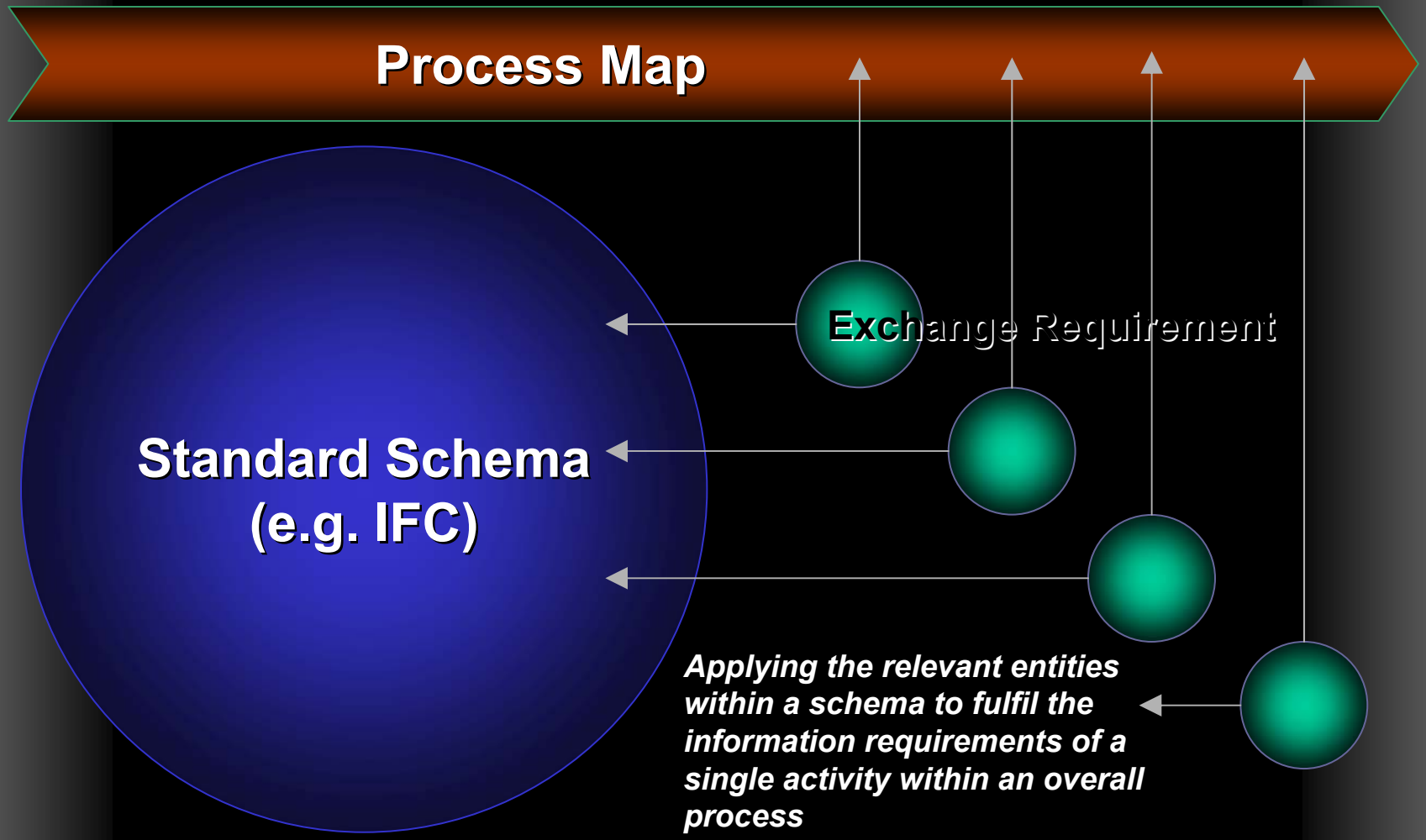
Linking IFC With Industry Processes



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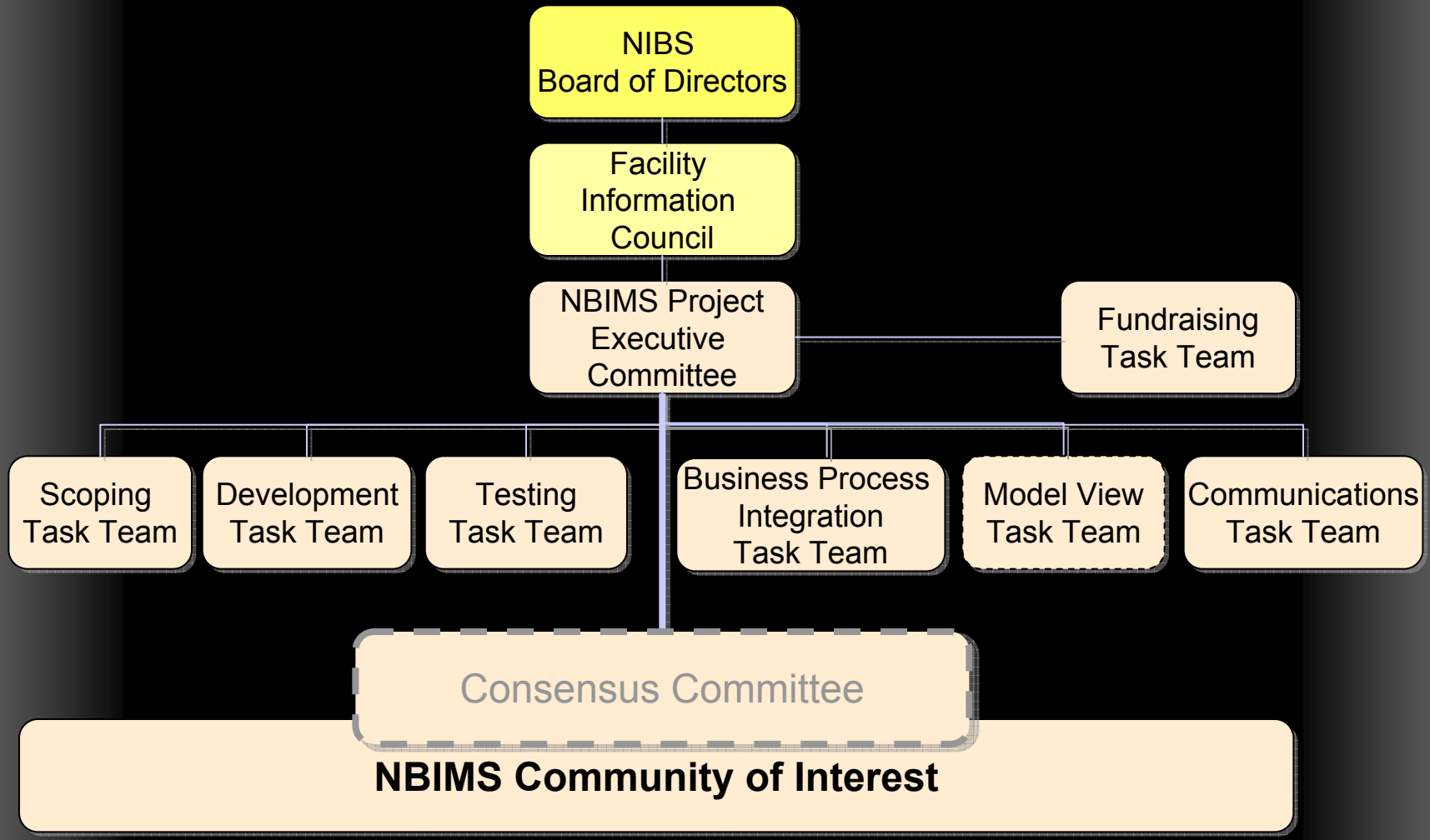
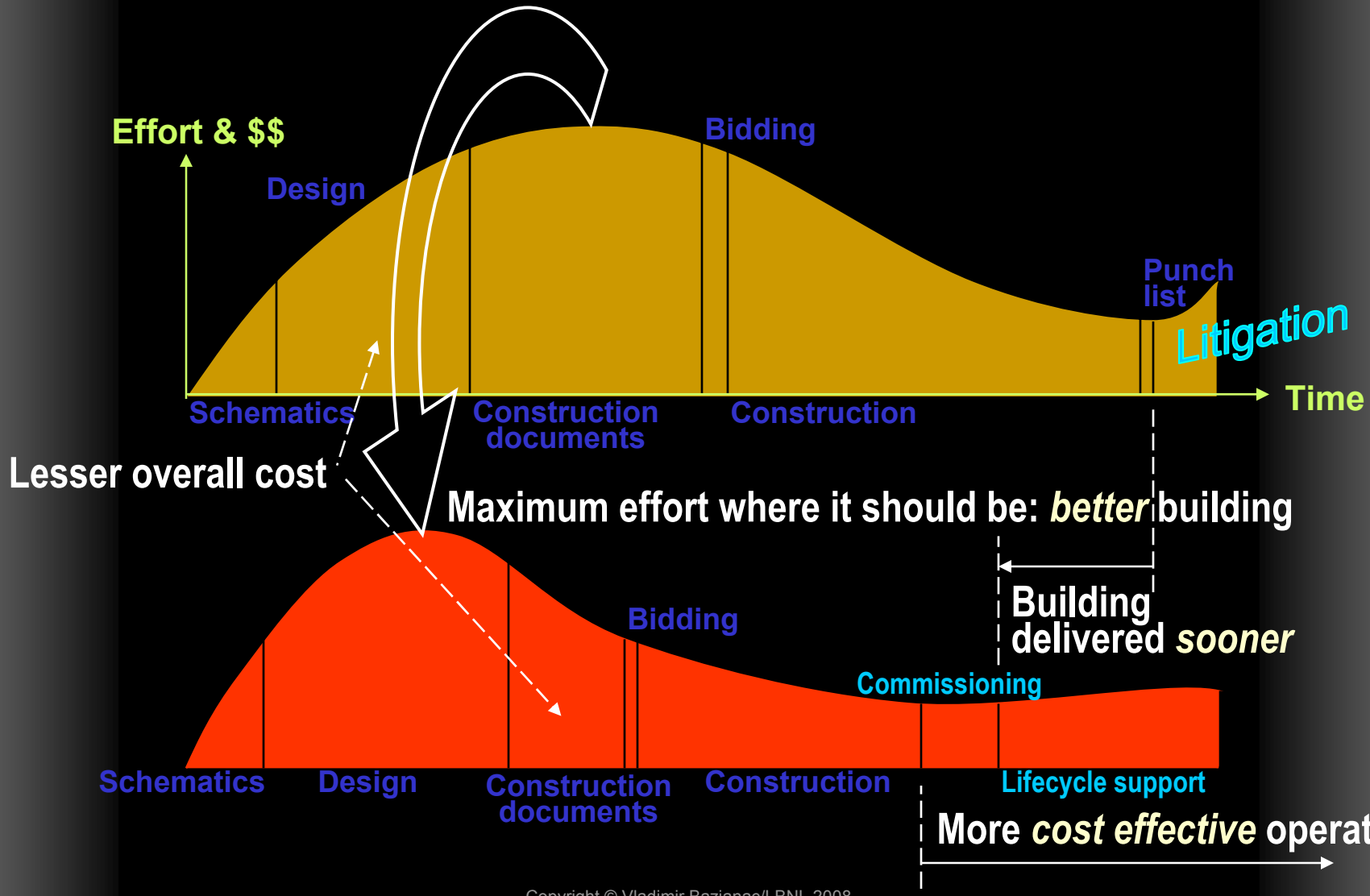
NBIMS Organization Chart



NBIMS Impact On AECOO Industry

- All *professional* project work



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