KWARC: Knowledge Adaptation and Reasoning for Content

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Paradigm and Methods

- From Here: Roots in Foundational Research
  - Formal Methods: Specification, Deduction, Reuse
  - Knowledge Representation: Ontologies, Content/Context Markup
  - eLearning: Document management
  - Systems: OMEGA, OMDoc, MathML, OpenMath, MBase, MathWeb, HETS
- To There: Structural/Formal Technologies! (integrating formal/semi-formal)
  - Formal Methods: Informal FM, Heterogeneity, (I)FM for Science
  - Application: active scientific/technical documents
  - Technology: Semantic Interoperability, Change Management, Semantic Search
  - Systems: Formal Digital Libraries, EScience-Suite

Overview: KWARC Research and Projects

Applications: eMath 3.0, Active Documents, Semantic Spreadsheets, Semantic Help Systems, Semantic CAD/CAM, Change Mangagement, ...

Foundations of Math:

- MathML, *OpenMath*
- advanced Type Theories
- MMT: Modular Math Theories
- Logic Morphisms/Atlas
- Theorem Prover Interoperability

Knowledge Mgt. & Interaction:

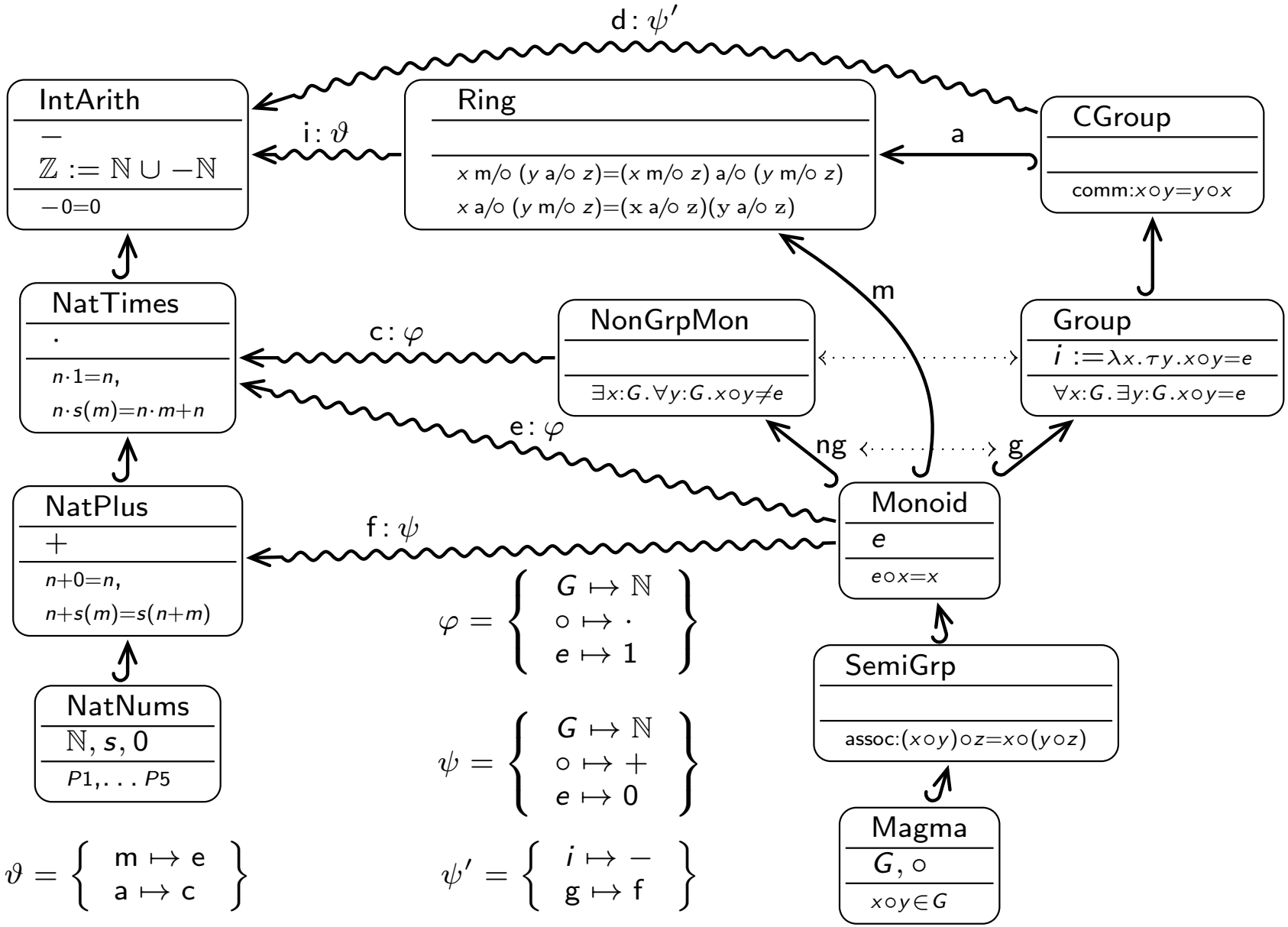
- Semantic Interpretation
- JOBAD: Document-Embedded Interaction
- TNTBase: Versioned XML Storage
- Math Archives

Semantization:

- LaTeXML: LaTeX $\rightarrow$ XML
- sTeX: Semantic LaTeX
- invasive editors
- Context-Aware IDEs
- Mathematical Corpora
- Linguistics of Math

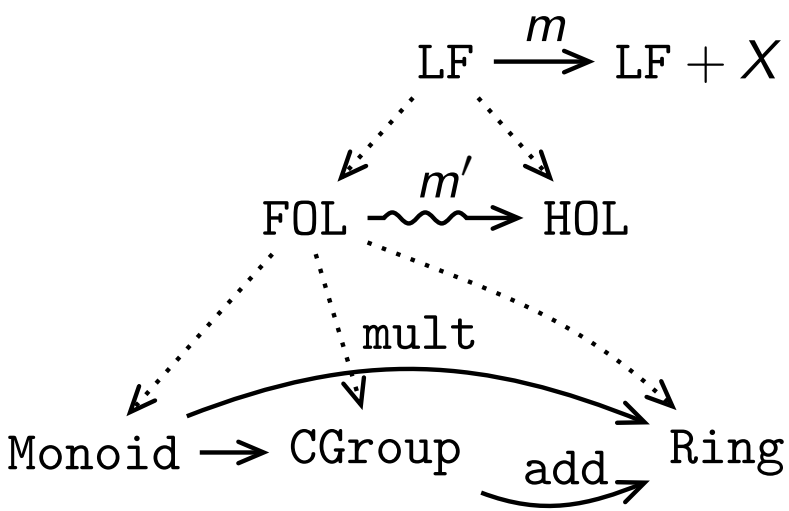
Foundations: Computational Logic, Web Technologies, *OMDoc*

Modular Representation of Math (MMT Example)



Representing Logics and Foundations as Theories

- Logics and foundations represented as theories (subject to the same module system)
- Meta-relation between theories (special case of inclusion)
- Semantics of logics represented as theory morphisms into the foundation, e.g., `folsem`
- Models represented as theory morphisms
  v_1 interprets monoid in integers using meta-morphism v_3



KWARC Slogan

Good Theory is the best Practice

Everything you can do, we can to Meta!

KWARC People I

- Prof. Dr. Michael Kohlhase (Professor; Project Lead)
  - Projects: *OMDoc*, sTEX, arXMLiv, NL Semantics, MathSearch...
  - Specializes: "world domination" (ubiquitous computer-supp. math)

- PD. Dr. Florian Rabe (Jacobs PostDoc)
  - Projects: *OMDoc*2, LATIN, MMT (loves category theory)
  - Specializes: metalogics, language design, math foundations, ...

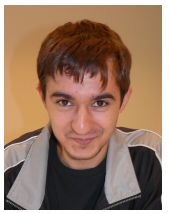
- Prof. Dr. Andrea Kohlhase (Hochschule Neu-Ulm)
  - Projects: SiSsI, PLANETARY, MathSearch
  - Specializes: Semantic Interaction, Semantic Design, HCI

- Constantin Jucovschi (Doctoral Student (Semantic Editing/Interaction))
  - Projects: FormalCAD, SiSsi, PLANETARY
  - Thesis: Integrated Development Environemtns for STEM Documents

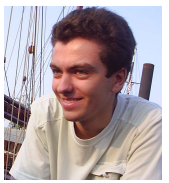
- Deyan Ginev (Doctoral Student (Math Linguistics))
  - Projects: LaMaPuN, arXMLiv, PLANETARY, sTEX, ...
  - Thesis: Semantizising Math Formulae

KWARC People II

- Michnea Iancu (Doctoral Student (*OMDoc2*))
  - Projects: MathSearch
  - Thesis: informal MMT, OAF



- Dennis Müller (Doctoral Student (*OMDoc2*))
  - Projects: Theorm Prover Libraries
  - Thesis: MMT, OAF



- Dr. Christian Maeder (Research Programmer)
  - Projects: OAF, MMT, FormalCAD

- M.Sc. Students: with thesis titles and ETA
  - Tom Wiesing: *Semantic Alliance, FormalCAD* (2017)
  - Xu He: *Symbolic Subymbolic Inference* (2017)
- B.Sc. Students Enxhell Luzhnica, Frederick Schaefer, Akbar Oripov, Jinbo Yuan, Hang Wang, Ion Toloaca... (do thesis research and help with the KWARC projects)