

双方向モデル変換によるソフトウェア開発に関する研究



# 双方向変換で ソフトウェアを進化させる

胡 振江  
国立情報学研究所  
アーキテクチャ科学研究系

# プロジェクトメンバー



胡振江 (教授)  
日高宗一郎 (助教)  
加藤弘之 (助教)  
稲葉一浩 (特任研究員)



武市正人 (教授)  
松田一孝 (ポスドク)  
熊英飛 (博士D3)



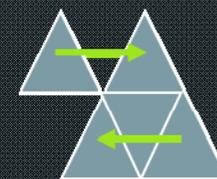
中野圭介 (助教)



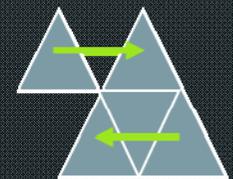
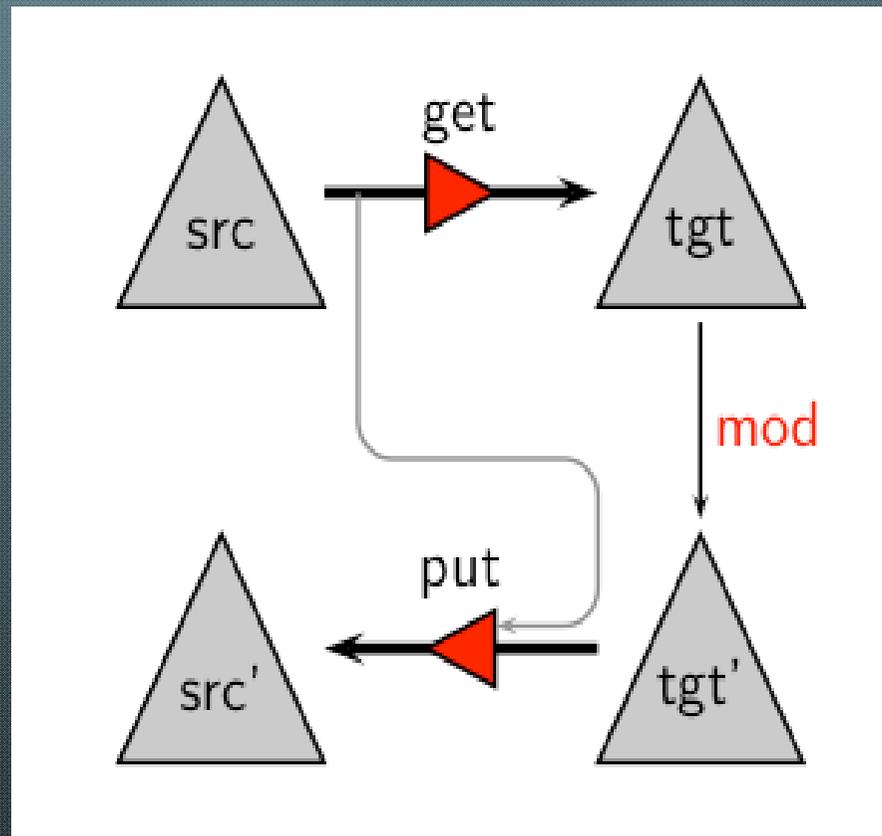
篠埜功 (助教)



梅宏 (教授)  
趙海燕 (准教授)  
Song Hui (Ph.D Cand.)



# 双方向变换(计算)

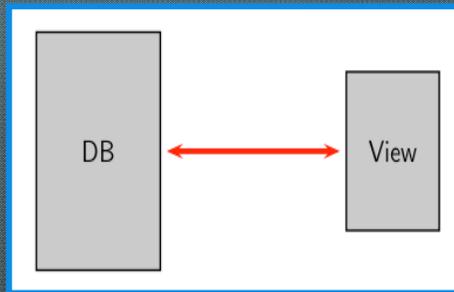


# 双方向変換の応用

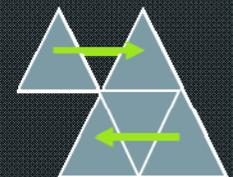
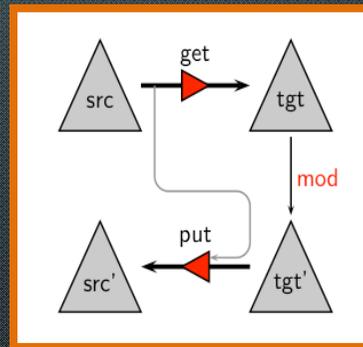
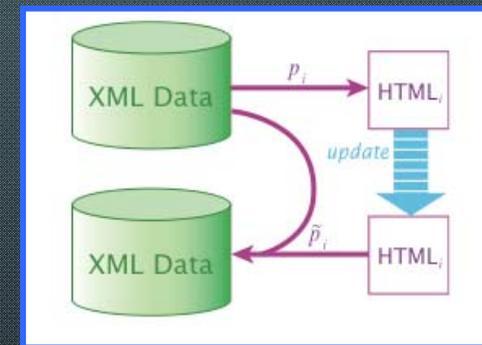
Data Synchronization (2006)



View Updating (80')



Web Maintainer (2008)



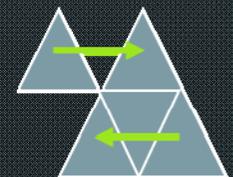
# 双方向変換言語

- 双方向計算ソフトウェア開発を支援する言語が必要

- **Lens** (for data sync) Univ. of Pennsylvania  
[POPL'06, PODS'06, ICFP'08]

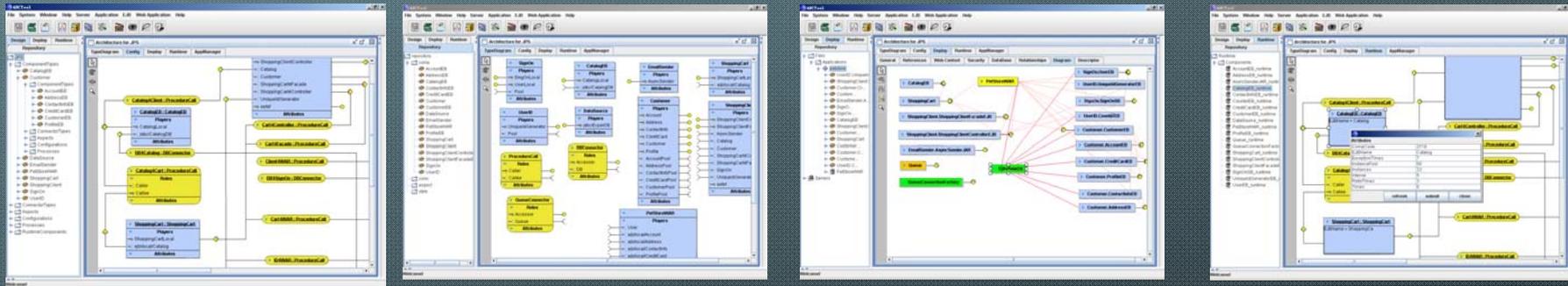
- **X/Inv/BiX** (for doc construction) 東大+ NII  
[PEPM'04, ICFP'07, HOSC'08, PEPM'09]

木上の双方向計算



# チャンレンジ

🌐 双方向的モデル駆動ソフトウェア開発(BMDD)を支援する言語を設計・実装できるか？



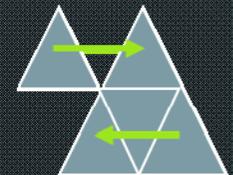
Model-based  
Requirements  
Analysis

Model-  
based  
Software  
Design

Model-based  
Component  
Composition

Model-based  
Application  
Deployment

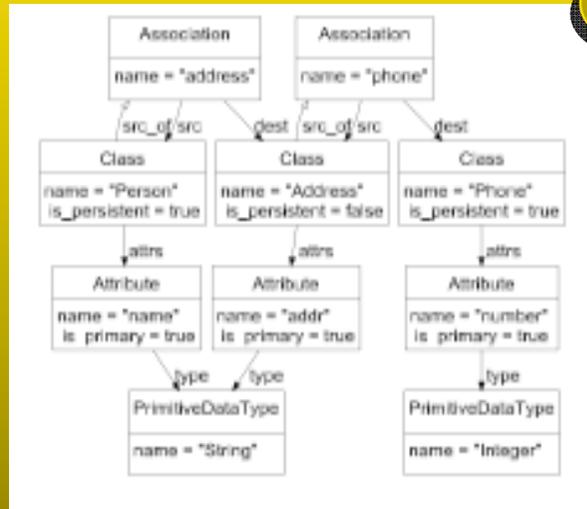
Model-based  
Testing



# チャンレンジ

- 🌐 双方向的モデル駆動ソフトウェア開発(**BMDD**)を支援する言語を設計・実装できるか？

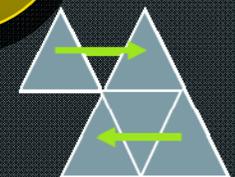
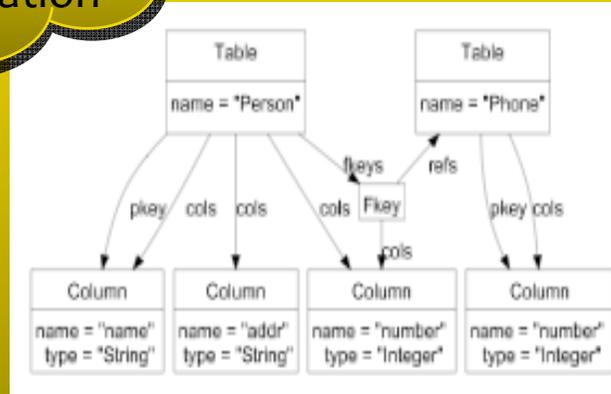
Class Model  
(Design)



Bidirectional  
Graph  
Transformation



Relational Model  
(Implementation)



# 双方向グラフ変換 記述言語 UnQL+

(\* replace *Attribute* \*)

replace{ $\$I_A : \$g$ } by{ *Column* :  $\$g$ } where  
 $\$db$  in

(\* replace *attrs* \*)

(replace{ $\$I_a : \$A$ } by{ *cols* :  $\$A$ } where  
 $\$class$  in

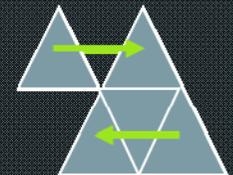
(\* select *classes* \*)

(select  $\$class$  where  
{ *Association*.(*src|dest*).*Class* :  $\$class$  }  
in  $\$classDB$ ,

{ *is\_persistent* : { *Boolean* : *true* } } in  $\$class$ ),

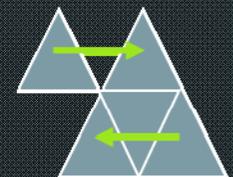
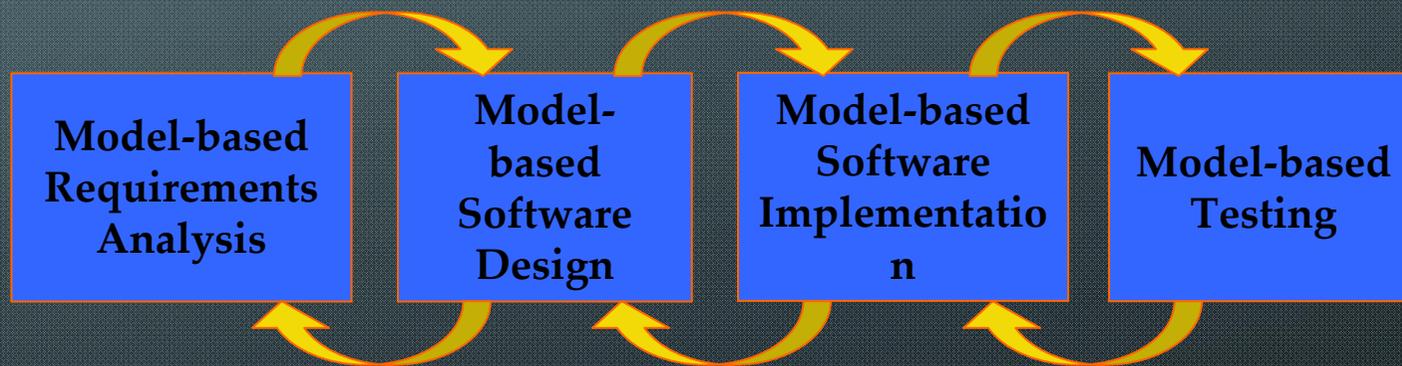
{ $\$I_a : \$A$ } in  $\$class$ ,  $\$I_a = \textit{attrs}$ ),

{ *cols* : { $\$I_A : \$g$ } } in  $\$db$ ,  $\$I_A = \textit{Attribute}$



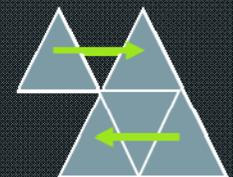
# 研究目標

- 進化可能なソフトウェア開発を支援する**次世代言語**の開発
  - **グラフ**を計算対象に
  - **双方向計算**



# 部分成果

- 🌐 モデル変換言語**ATLの双方向化** (ASE 2007)
- 🌐 グラフ問い合わせ言語から**グラフ変換言語**へ (SAC 2009)
- 🌐 **双方向グラフ変換** (ICSE 2009, NIER Track)
- 🌐 Beanbag: **モデル同期器**の生成器 (FSE'09, ICMT'09)
- 🌐 Application: Runtime Architecture Infrastructure



# 1<sup>st</sup> GRACE International Meeting on Bidirectional Transformation

Shonan Village Center, Japan, 2008



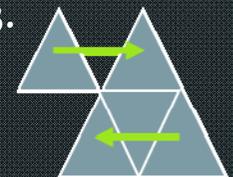
Bidirectional Transformations: A Cross-Discipline Perspective  
-- GRACE meeting notes, state of the art, and outlook --,  
International Conference on Model Transformation (ICMT 2009),  
ETH Zurich, Switzerland, June 29-July 3 2009. LNCS 5563, Springer. pp.260-283.



NII Open House 2009

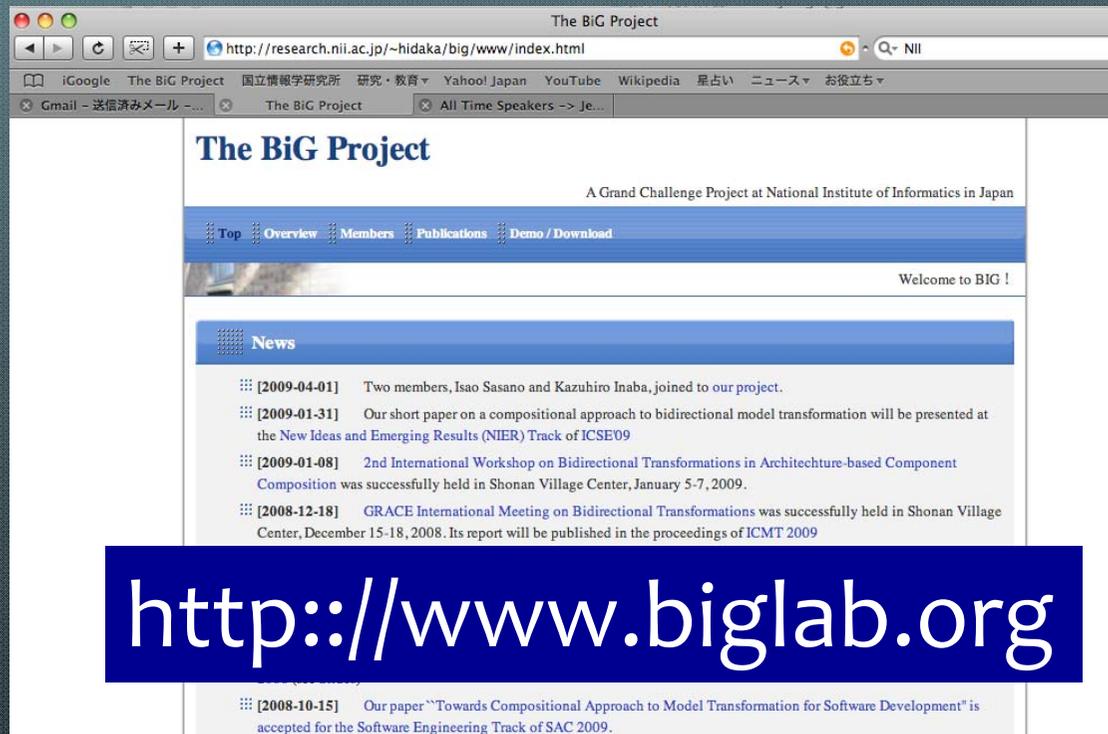
11

June 11, 2009



# BiG プロジェクトページ

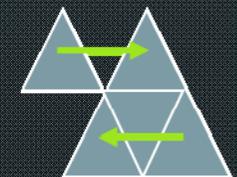
 It includes all papers and systems



The screenshot shows a web browser window displaying the BiG Project website. The browser's address bar shows the URL <http://research.nii.ac.jp/~hidaka/big/www/index.html>. The website header includes the title "The BiG Project" and the subtitle "A Grand Challenge Project at National Institute of Informatics in Japan". A navigation menu contains links for "Top", "Overview", "Members", "Publications", and "Demo / Download". Below the menu, there is a "Welcome to BIG!" message and a "News" section. The news section lists several updates with dates and descriptions:

- [2009-04-01] Two members, Isao Sasano and Kazuhiro Inaba, joined to our project.
- [2009-01-31] Our short paper on a compositional approach to bidirectional model transformation will be presented at the New Ideas and Emerging Results (NIER) Track of ICSE09
- [2009-01-08] 2nd International Workshop on Bidirectional Transformations in Architecture-based Component Composition was successfully held in Shonan Village Center, January 5-7, 2009.
- [2008-12-18] GRACE International Meeting on Bidirectional Transformations was successfully held in Shonan Village Center, December 15-18, 2008. Its report will be published in the proceedings of ICMT 2009
- [2008-10-15] Our paper "Towards Compositional Approach to Model Transformation for Software Development" is accepted for the Software Engineering Track of SAC 2009.

A large blue banner at the bottom of the screenshot contains the URL <http://www.biglab.org>.

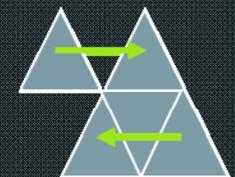


# ポスター319

ソフトウェアの開発過程記述からソフトウェアを進化させる

## 双方向モデル変換の言語的基盤技術に関する研究

国立情報学研究所: 胡振江, 日高宗一郎, 加藤弘之, 稲葉一浩      東京大学: 武市正人, 松田一孝  
電気通信大学: 中野圭介      芝浦工業大学: 篠埜功      北京大学: Hong Mei, Haiyan Zhao



# ポスター321

## グラフ変換の双方向化と双方向モデル変換への応用<sup>†</sup>

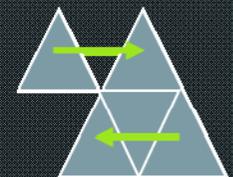
Bidirectionalization of Graph Transformation and its Application to Bidirectional Model Transformation

日高宗一郎  
Soichiro HIDAKA

胡振江  
Zhenjiang HU  
国立情報学研究所  
National Institute of Informatics

加藤弘之  
Hiroyuki KATO

中野圭介  
Keisuke NAKANO  
電気通信大学  
The University of Electro-Communications



# 募集

- 🌐 意欲満々、素晴らしい**学生**
- 🌐 最新技術をソフトウェア開発現場に応用したい**企業**

THANK YOU!

