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Model Driven Development of Graphical User Interfaces - Experience, Lessons Learnt and a Way Forward

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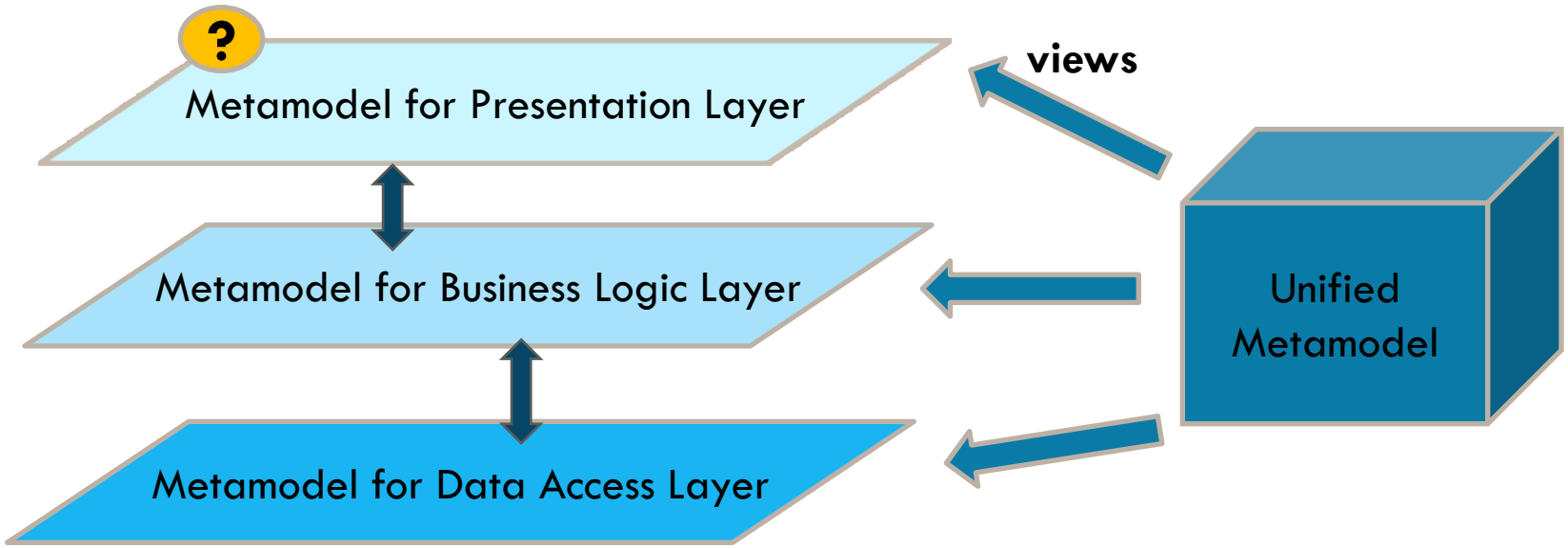
Applying MDD to Database Centric Business Applications



Unified Metamodel ensures consistency across layers

Modeling Presentation Layer

- Realizes the user view of a business process
  - Screens are inter-connected with Navigation Links
- Four principal aspects of modeling screens

Presentation
- What does it look like?

User Interaction
- What can I do with it?

Event Reaction
- How does it react to my actions?

Data Flow
- How does it manage the data?

Widget Types

Widget-type Examples: Textbox, Dropdown box, Slider, Tabbed Pane, Editable Grid…

•Screens are composed of widgets (i.e widget type instances)

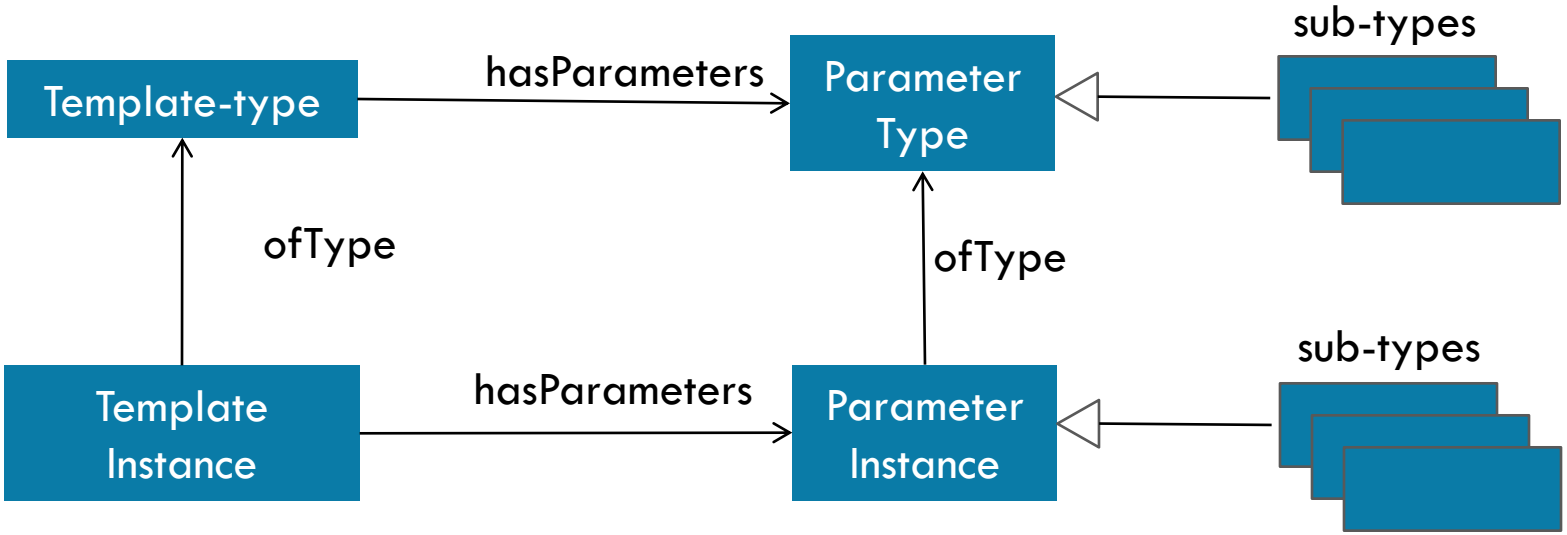
•Presentation and User Interaction capabilities depend on the widget type library for a platform

Widget type library for a platform is decided by what can be simulated on the platform

Widgets - Template Based Approach

- Widgets are instance of widget types
- A widget type has most of the implementation static → Templates

Modeling Templates



An Example – Grid Widget Type

1.Label

2. Grid Data

Existing Mutual Fund Orders

Partner	Instrument	Buy / Sell	Currency	Amount / Quantity	Price	Order Status	Reject
Bnp Paribas- Classic Capitalisation	IE0031005543-HSBC EUROPEAN GROWTH	Sell	EUR	UNITS 55.00	12.00	Executed	Reject
Bnp Paribas- Classic Capitalisation	100-HSBC Fund	Buy	EUR	UNITS 100.00	0.00	Authorised	Reject
Bnp Paribas- Classic Capitalisation	IE0031005543-HSBC EUROPEAN GROWTH	Sell	EUR	UNITS 55.00	12.00	Executed	Reject
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Bnp Paribas- Classic Capitalisation	100-HSBC Fund	Buy	EUR	UNITS 100.00	0.00	Authorised	Reject

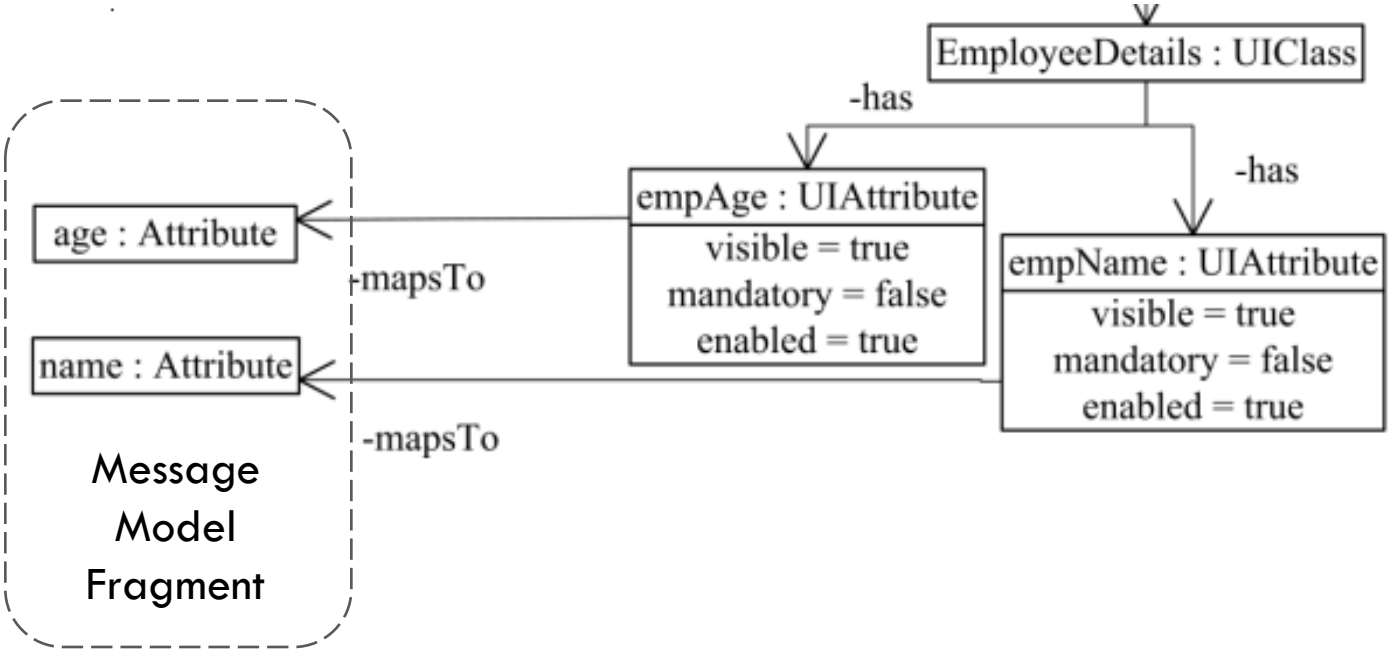
1 2 3 4 5 6 7 8 9 10

3. The grid data is fetched from application layer using a Data Fetch Service

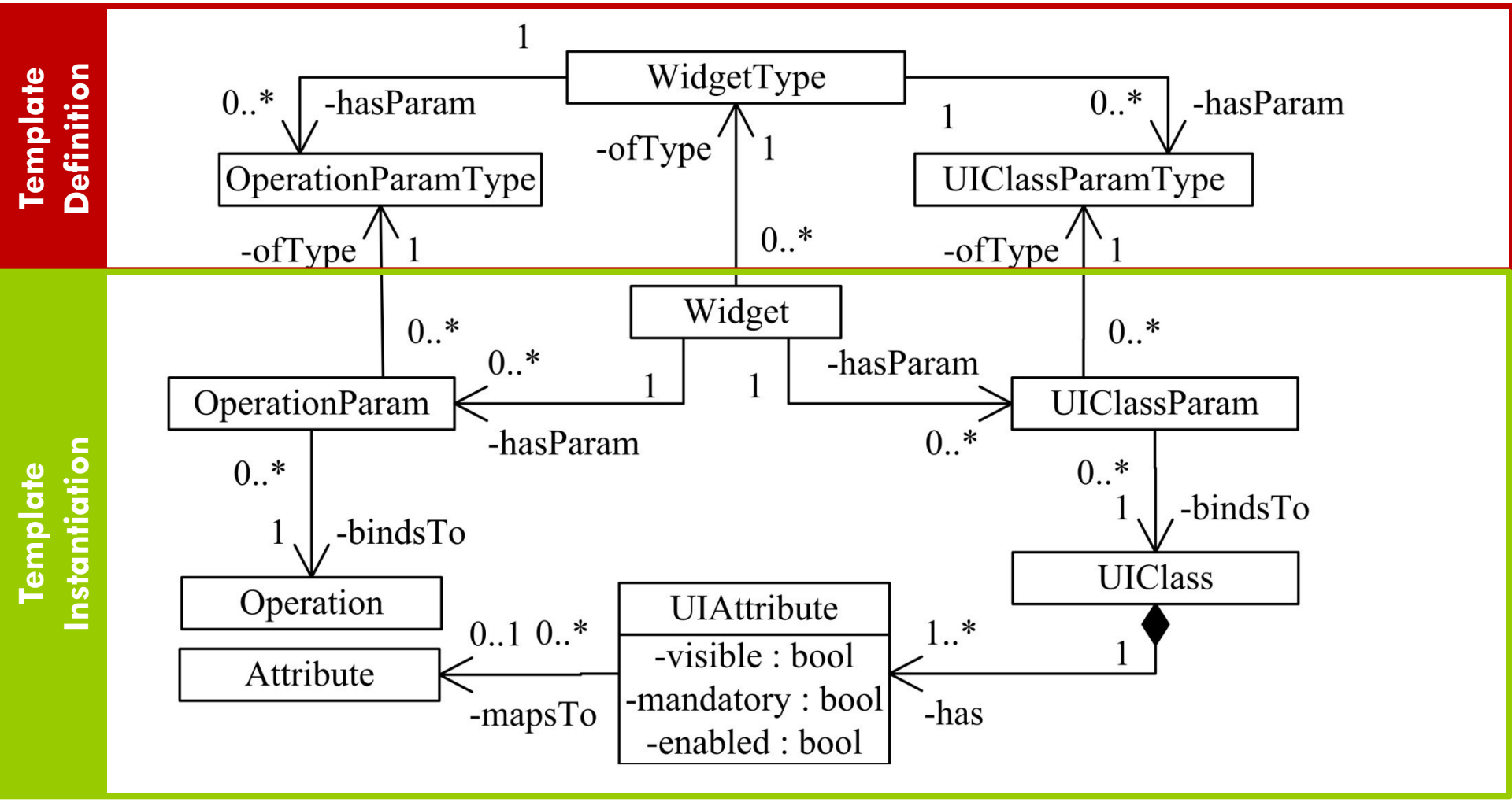
Template Parameters

- Parameters required to instantiate a widget type:
  - UIClassParamType for supplying content
  - OperationParameterType for supplying operations/services

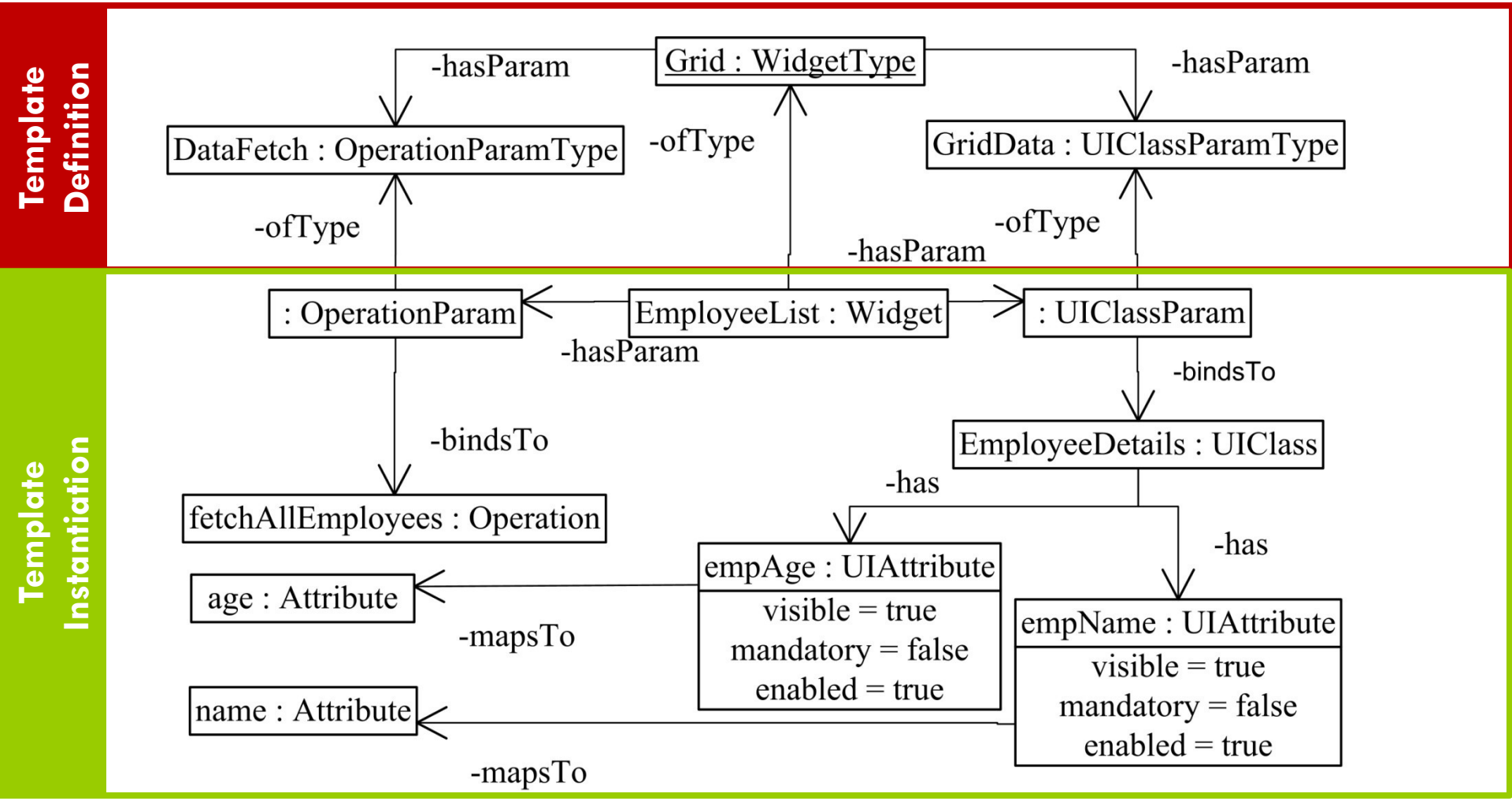
- Content is a projection over the message model (called UIClass)



Modeling Widget-types as templates (Metamodel)



Example – Grid Widget Type (Model)



Composite Widget Types / Templates

For example, a Search Window Template

All tasks...
Business Partner
Account
BP Interest Condition

Deal

Deal

1.Label

b/s "instrument" "maturity year" amount@price

Hide options ...

Instrument | Quantity | Price

Counter Party | Portfolio | Date

2.Search Criteria

4.Search Service

Make Deal ↵ | Hold | Limit | Start Fresh

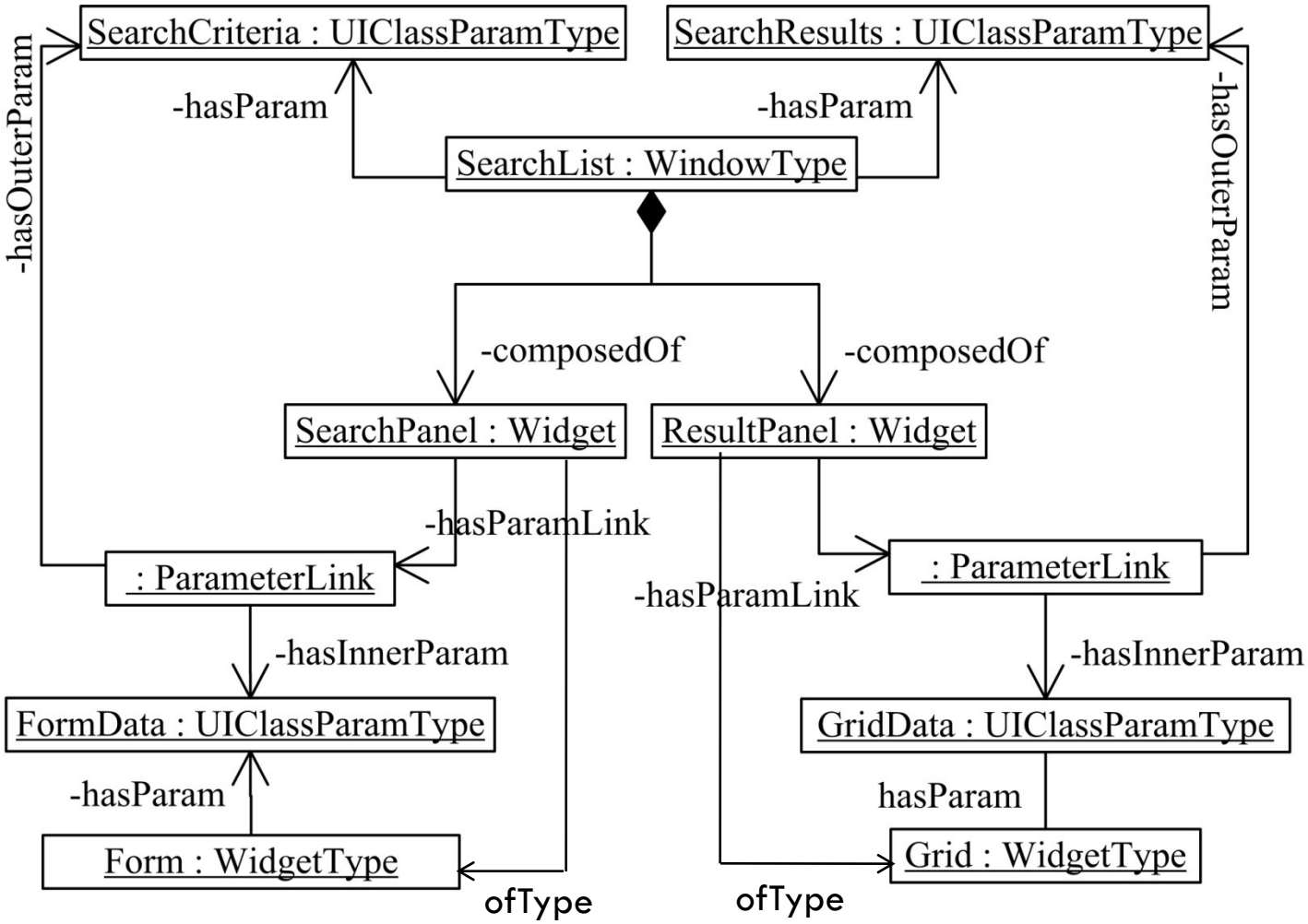
Hide

3.Search Results

Deals

Deal #	Trade	Execution	Instrument	Quantity	Price	Counter Party
103096	Out Right	Buy-T+0	0% 182 days TB 23-Mar-07	95693	275	Yardley I. Velez
103097	LAF	Buy-T+0	0% 182 days TB 23-Mar-07	1561	998	Tallulah H. Kerr
103098	Out Right	Buy-T+0	5.64% G.S 2019	91917	501	Wyoming Q. Gonzales
103099	LAF	Buy-T+0	5.64% G.S 2019	13998	294	Jescie W. Rivera
103100	LAF	Buy-T+0	5.64% G.S 2019	66034	923	Cherokee Z. Harding
103101	LAF	Buy-T+0	5.64% G.S 2019	66104	507	Teagan J. Gibson
103102	Out Right	Buy-T+0	0% 182 days TB 23-Mar-07	33097	559	Wynne V. Reeves
103103	Out Right	Buy-T+0	5.64% G.S 2019	55763	217	Leonard D. Fry
103104	LAF	Buy-T+0	5.64% G.S 2019	97945	403	Kaden E. Gregory

Composite Templates - Definition



Experience (1995 – till now)

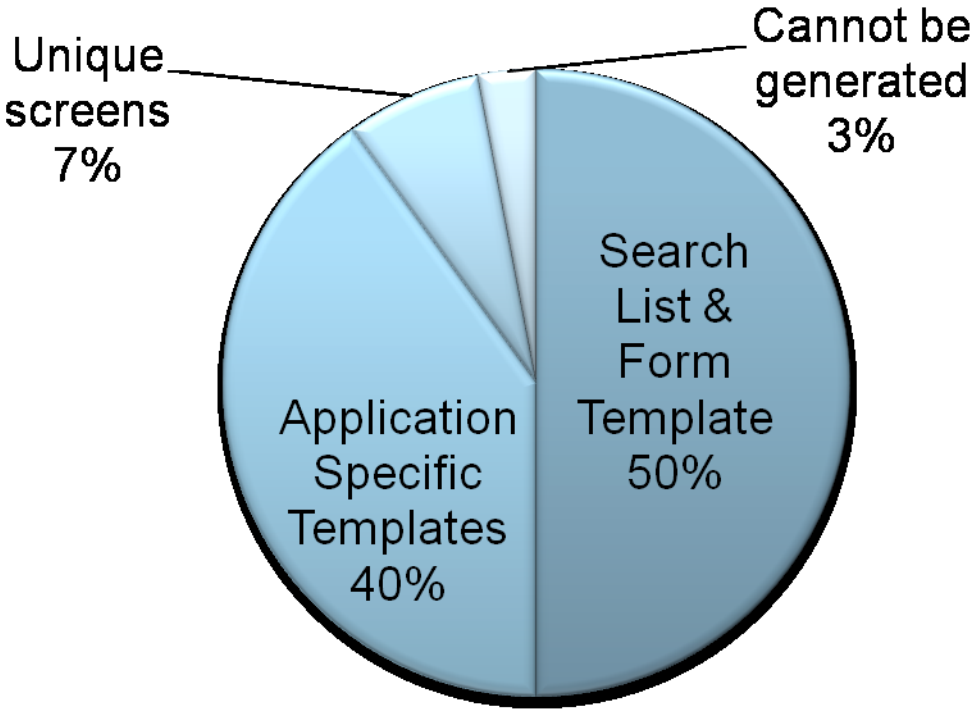
Usage	• A Financial Product Line (>1000 Screens) • Several large applications (>100 Screens each)
Coverage	☺ > 95% of Screens developed
Productivity	☺ Up by 2-3 times
Retargetability	1995 – PowerBuilder 1997 – Java Swing 2002 – JSP/Servlets & ASP.Net 2003 – Struts 2007 – JSF
Quality & Consistency	☺ Uniformly higher quality ☺ Consistency across screens
Testing	☺ Screens could be tested independently and integrated with services later on with minimal problems.
Change Management	☺ Automated Impact Analysis
Ease of Use	☹ High learning curve, mostly due to dialog based modeling ☹ Poor control on layout

Experience (1995 – till now)

Customization	☹Difficult to customize ☹Proprietary template language
Tool Extensibility	☹ No handle on extensibility

Lessons Learnt

- Templates are highly useful



A mechanism to easily create templates can improve productivity and quality

Lessons Learnt (contd)

- Platform Independence
  - All GUIs on all platforms is difficult
  - Our approach is for a class of GUIs on a class of platforms, which proved useful
- Tool extensibility is vital for proliferation
- Complexity in metamodel reflects as complexity in code generators and in tooling, which affects customizability and tool extensibility
- A visual screen designer can reduce the turnaround time for changes, especially for layout changes
- Aligning to UML does not help since a custom meta-model which treats templates as first class concepts is easier to work with.
- Better code generation languages with good localized separation of concerns would improve customizability
- Quick generation of prototypes is an essential feature for business application development

Ongoing Work

- A simplified approach where,
  - the widget library acts as the metamodel
  - templates are composed of widgets and not other templates
  - code generators are straight-forward

- Standards adoption
  - MOF described modeling infrastructure
  - MOF Model2Text for code generation

- Adaptive, visual modeling tool → Tool Extensibility

- Quick Prototype Generation

- Variability management in GUIs for Software product lines using the new approach for GUI Modeling

- Business process driven, multi-channel user interaction

Questions?