The 8th OOPSLA Workshop on Domain-Specific Modeling

Nashville, TN, USA, 19-20 October 2008 (Room 210)

ModelTalk:

A Framework for Developing Domain Specific Executable Models

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Pontis Ltd., Israel

Joint Work With:

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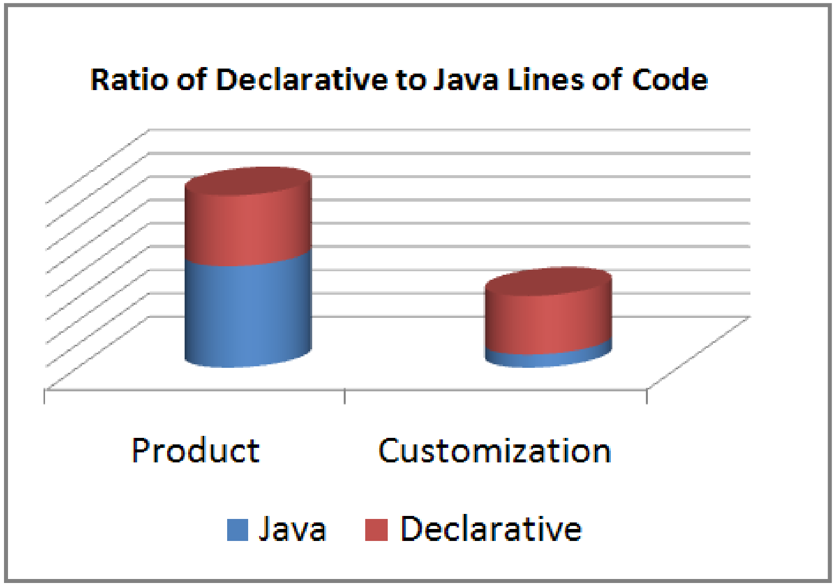
The Open University of Israel

The Challenge:
Telco-grade Dependability with Extreme Agility

- **Telecommunications** Business Support System (BSS)
  - Customers: Communication service providers
  - Product: Marketing delivery platform
- **Problem Space**
  - Strict extra-functional requirements
  - Pervasive customization
  - Frequent updates
- **Solution Space**
  - Third-party components (Main-stream J2EE technologies)
  - Domain-specific model-driven development
  - Product-line software engineering

ModelTalk Facts

- **Interpretive Approach**
  - Short edit-execute cycle
  - Minimum changes to binary code
  - Meta-model changes are automatically reflected in the tool
- **Commercial Experience**
  - 50 developers; >20 systems
  - 50 TPS/CPU.
  - Response time:
    70 ms average,
    250 ms 99%
- **Customization**
  - Time and effort dropped by an order of magnitude
  - 82% declarative

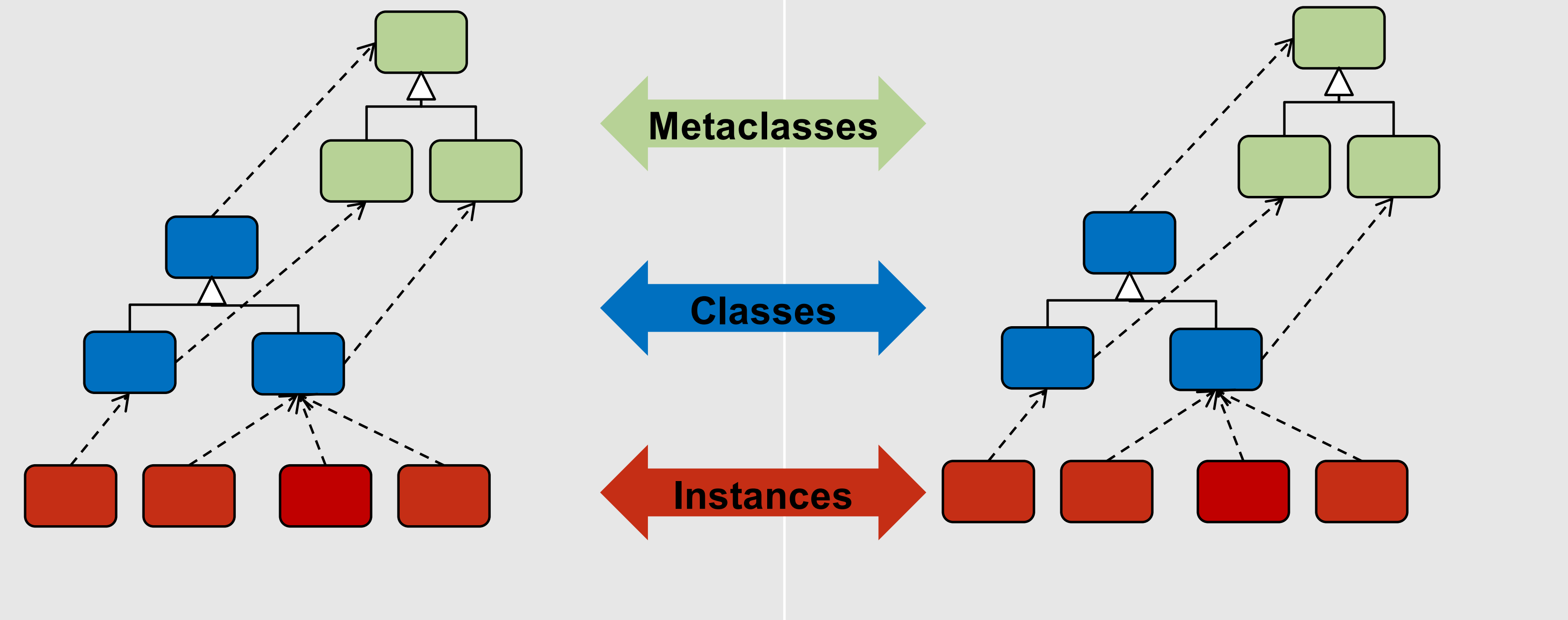


Agenda

- ✓ Introduction
- ✓ ModelTalk Facts
- **The ModelTalk Approach**
- ModelTalk in Action
- Conclusion

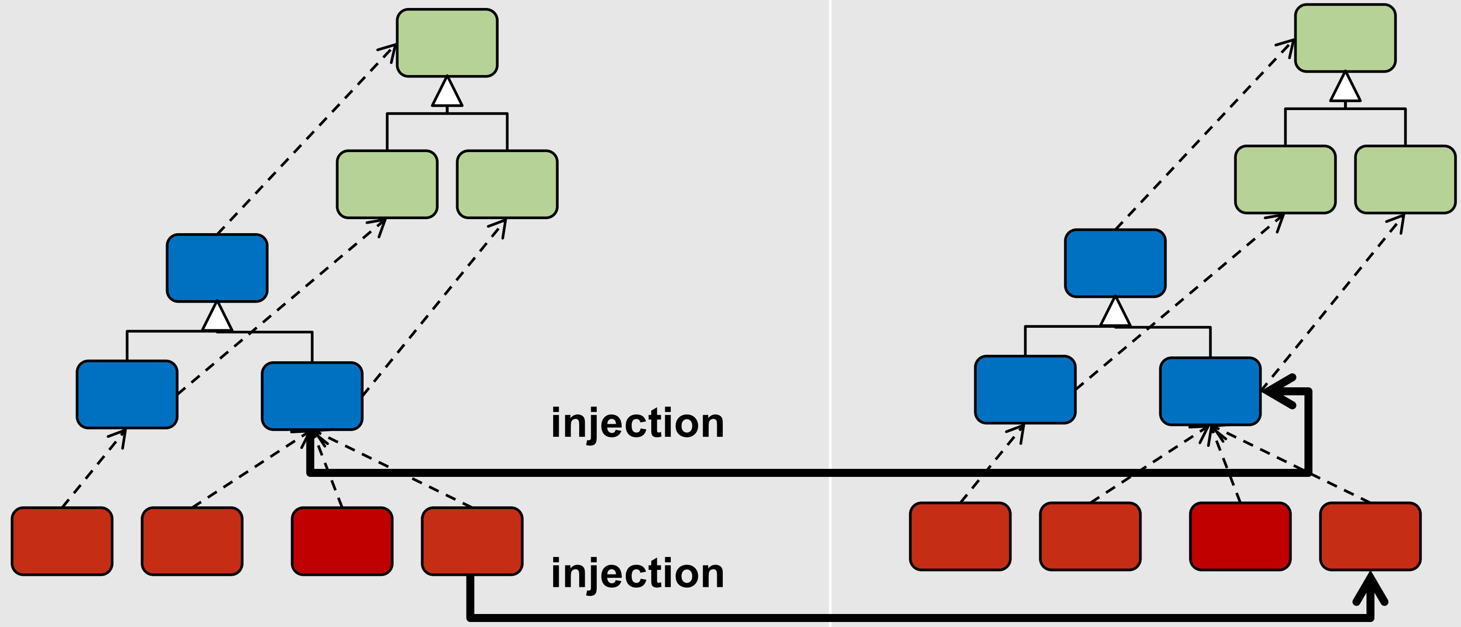
The ModelTalk Approach (1/3)

Model (XML)	Code (Java)
- Structure and static state - Instances, Classes, Meta-classes	- Behavior - ModelTalk managed Java classes



ModelTalk Dependency Injection (2/3)

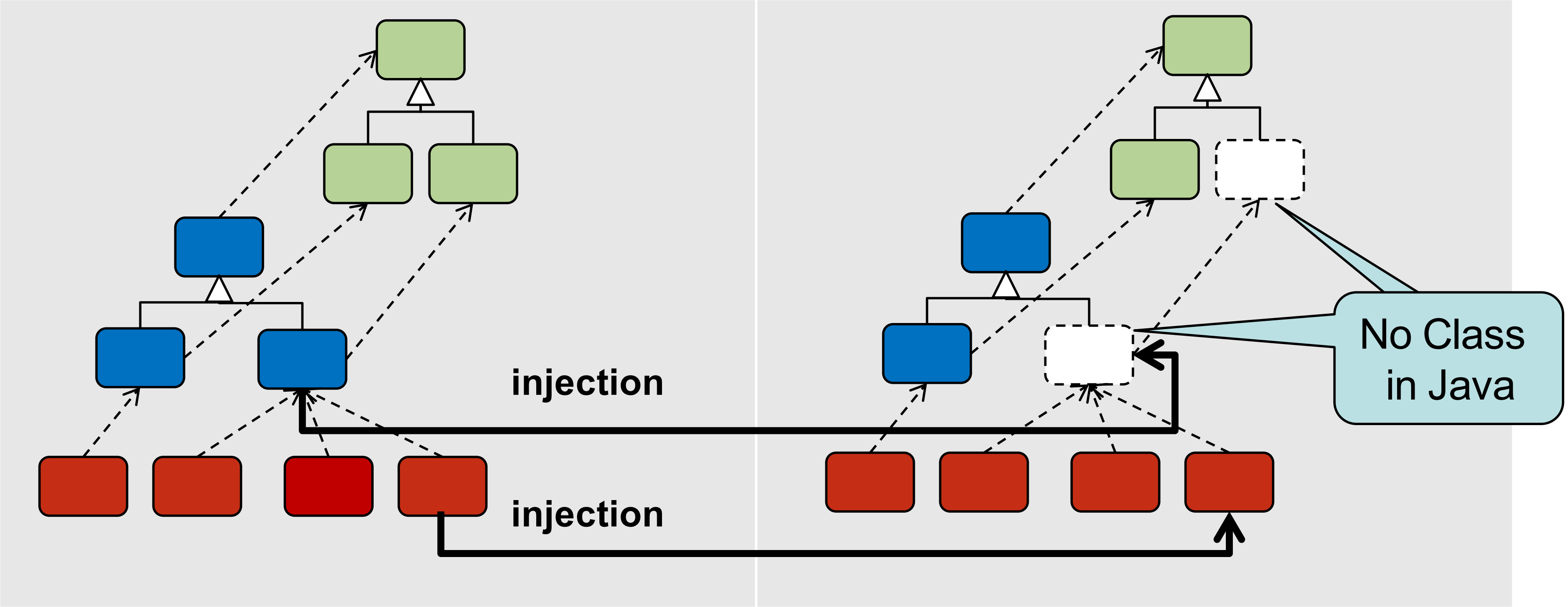
Model (XML)	Code (Java)
- Model Driven Dependency Injection - Model instances are constructed and injected into Java instances	



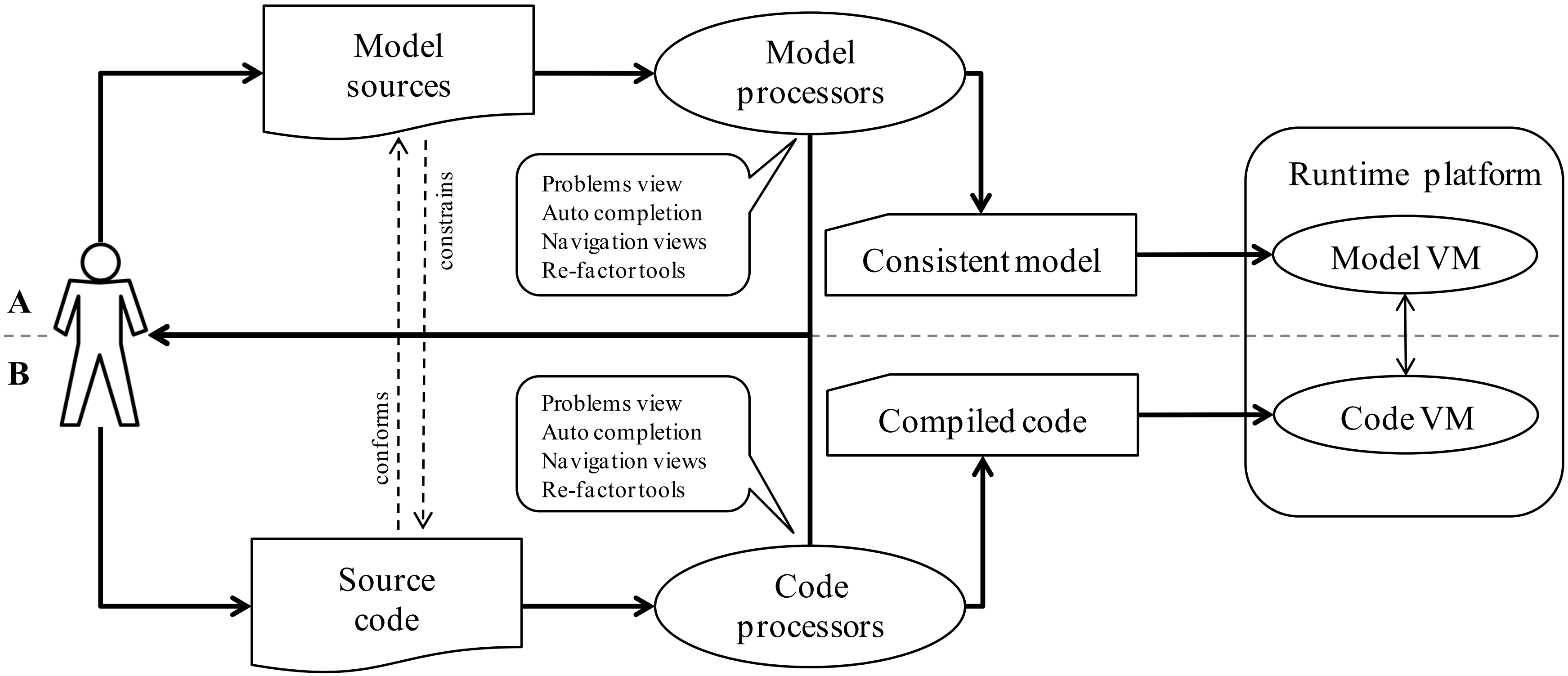
ModelTalk Adaptability (3/3)

Model (XML)	Code (Java)

- Mapping permits “holes” on the Java side
- Holes enable Java-less model change process



The ModelTalk Architecture



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- **ModelTalk in Action**
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ModelTalk in Action

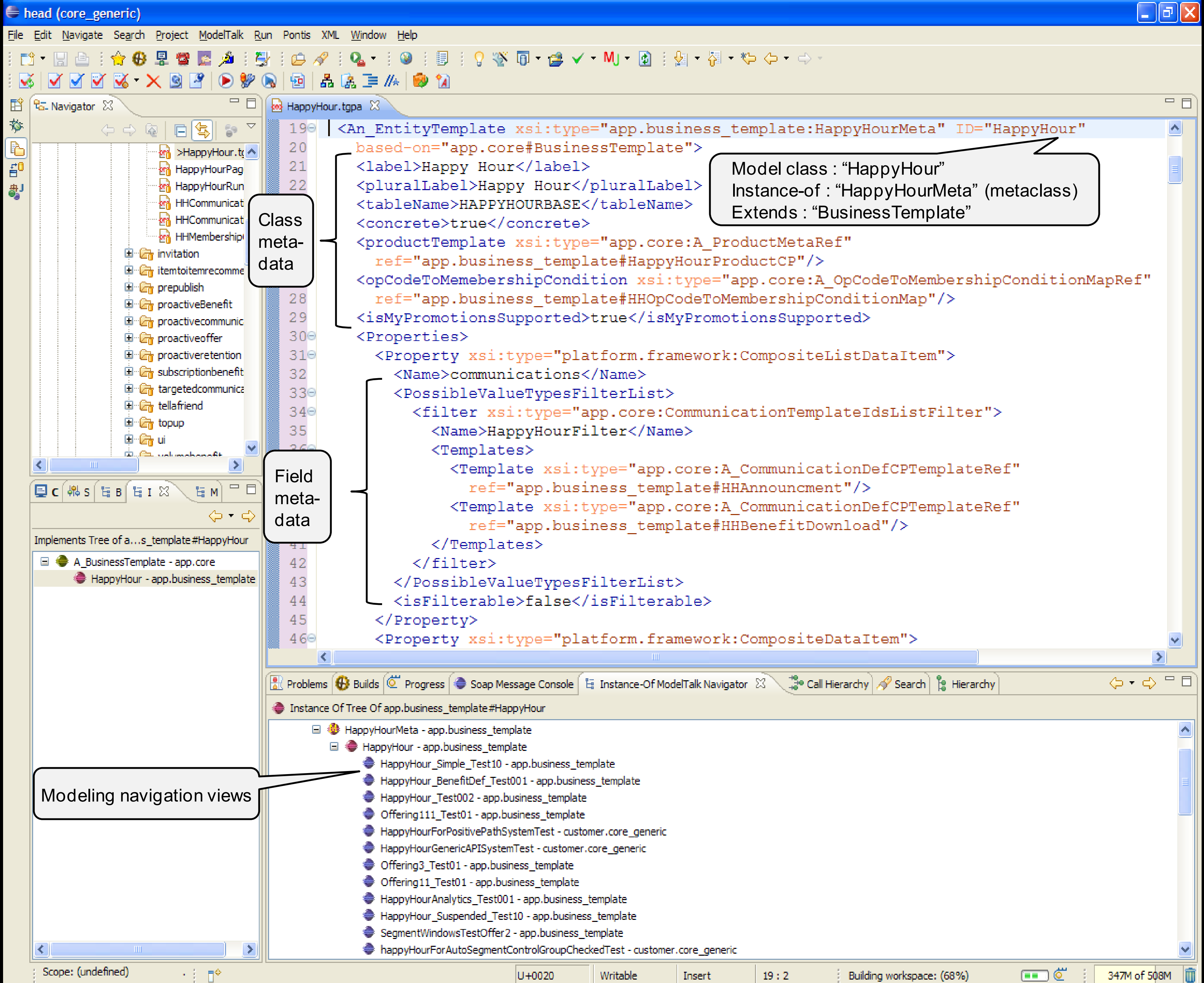
- **Objective**
  - Look and feel of the ModelTalk IDE
- **Example**
  - Customizing the Pontis application for OOPSLA in less than 10 minutes…
  - OOPSLA Happy Hour promotion
    - **$20 discount on selected OOPSLA tutorials during Oct 19-20, 2008.**

Demo: Edit-Execute Cycle (1/2)

Part I: The Programmer Perspective

- Create a HappyHour instance
- Add the HappyHour instance to the DB
- Customize UI labels
- Manipulate the HappyHour instance in the GUI

Model-Code IDE → Easier assimilation
Model-compilation → Controlled declarative changes
Meta-object extensibility → Meta-Data = Data


head (core_generic)
File Edit Navigate Search Project ModelTalk Run Pontis XML Window Help
Navigator
HappyHour.tgpa
C S B I M
Problems Builds Progress Soap Message Console Instance-Of ModelTalk Navigator Call Hierarchy Search Hierarchy
Scope: (undefined)
U+0020 Writable Insert 19 : 2 Building workspace: (68%) 347M of 508M

```
<An_EntityTemplate xsi:type="app.business_template:HappyHourMeta" ID="HappyHour"
  based-on="app.core#BusinessTemplate">
  <label>Happy Hour</label>
  <pluralLabel>Happy Hour</pluralLabel>
  <tableName>HAPPYHOURBASE</tableName>
  <concrete>true</concrete>
  <productTemplate xsi:type="app.core:A_ProductMetaRef"
    ref="app.business_template#HappyHourProductCP"/>
  <opCodeToMemebershipCondition xsi:type="app.core:A_OpCodeToMembershipConditionMapRef"
    ref="app.business_template#HHOpCodeToMembershipConditionMap"/>
  <isMyPromotionsSupported>true</isMyPromotionsSupported>
  <Properties>
    <Property xsi:type="platform.framework:CompositeListDataItem">
      <Name>communications</Name>
      <PossibleValueTypesFilterList>
        <filter xsi:type="app.core:CommunicationTemplateIdsListFilter">
          <Name>HappyHourFilter</Name>
          <Templates>
            <Template xsi:type="app.core:A_CommunicationDefCPTemplateRef"
              ref="app.business_template#HHAnnouncment"/>
            <Template xsi:type="app.core:A_CommunicationDefCPTemplateRef"
              ref="app.business_template#HHBenefitDownload"/>
          </Templates>
        </filter>
      </PossibleValueTypesFilterList>
      <isFilterable>false</isFilterable>
    </Property>
    <Property xsi:type="platform.framework:CompositeDataItem">
```

Model class : “HappyHour”
Instance-of : “HappyHourMeta” (metaclass)
Extends : “BusinessTemplate”

Class meta-data

Field meta-data

Navigator:

```
>HappyHour.tg
HappyHourPag
HappyHourRun
HHCommunicat
HHCommunicat
HHMembership
invitation
itemtoitemrecomme
prepublish
proactiveBenefit
proactivecommunic
proactiveoffer
proactiveretention
subscriptionbenefit
targetedcommunica
tellafriend
topup
ui
volumebenefit
```

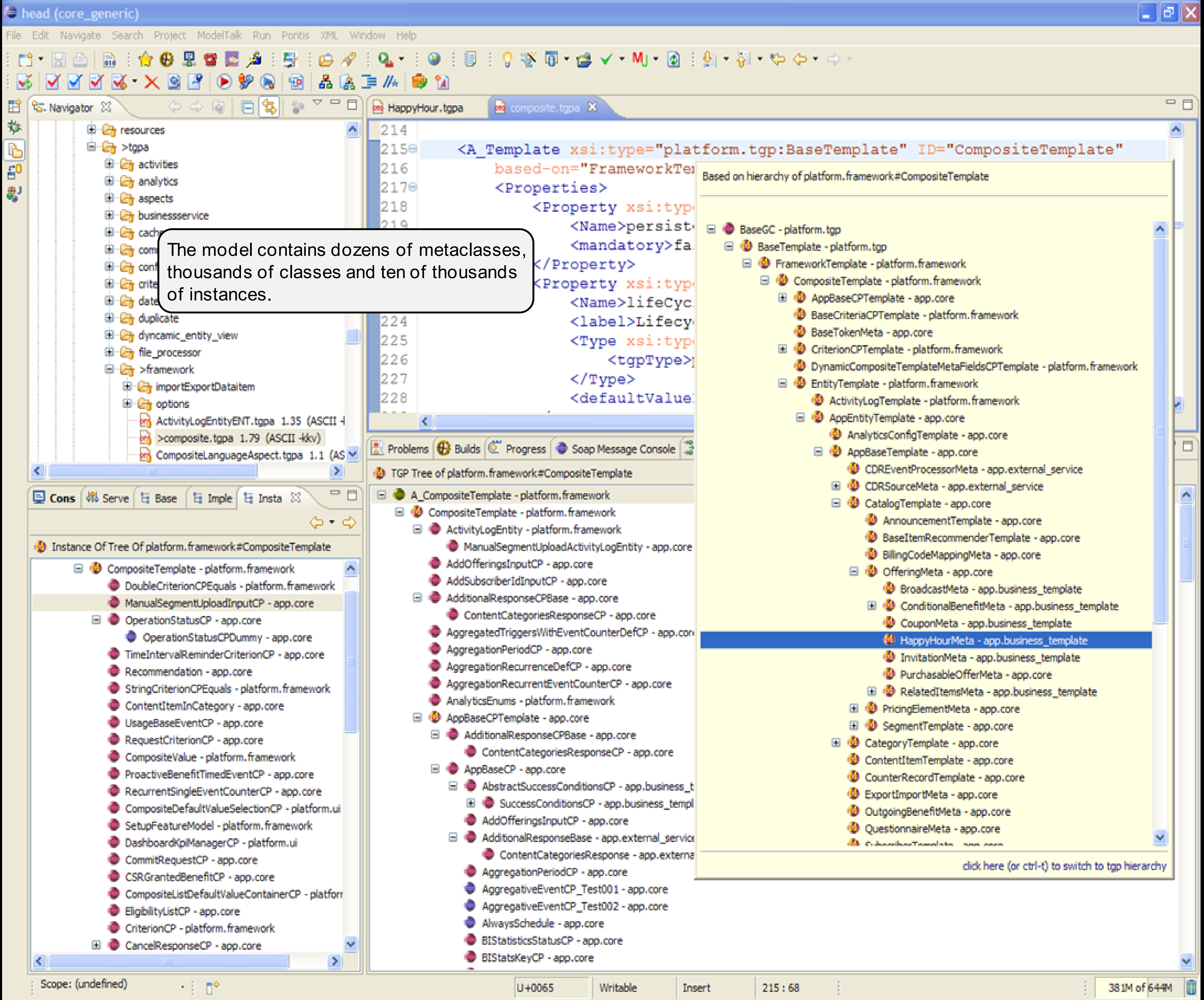
Implements Tree of a...s_template#HappyHour

```
A_BusinessTemplate - app.core
   HappyHour - app.business_template
```

Instance Of Tree Of app.business_template#HappyHour

```
HappyHourMeta - app.business_template
  HappyHour - app.business_template
    HappyHour_Simple_Test10 - app.business_template
    HappyHour_BenefitDef_Test001 - app.business_template
    HappyHour_Test002 - app.business_template
    Offering111_Test01 - app.business_template
    HappyHourForPositivePathSystemTest - customer.core_generic
    HappyHourGenericAPISystemTest - customer.core_generic
    Offering3_Test01 - app.business_template
    Offering11_Test01 - app.business_template
    HappyHourAnalytics_Test001 - app.business_template
    HappyHour_Suspended_Test10 - app.business_template
    SegmentWindowsTestOffer2 - app.business_template
    happyHourForAutoSegmentControlGroupCheckedTest - customer.core_generic
```

Modeling navigation views



The model contains dozens of metaclasses, thousands of classes and ten of thousands of instances.

```
resources
>tgpa
  activities
  analytics
  aspects
  businessservice
  cach
  com
  conf
  crite
  date
  duplicate
  dyncamic_entity_view
  file_processor
  >framework
    importExportDataitem
    options
    ActivityLogEntityENT.tgpa  1.35  (ASCII -
    >composite.tgpa  1.79  (ASCII -kkv)
    CompositeLanguageAspect.tgpa  1.1  (AS
```

```
    <A_Template xsi:type="platform.tgp:BaseTemplate" ID="CompositeTemplate"
        based-on="FrameworkTe
        <Properties>
            <Property xsi:typ
                <Name>persist
                <mandatory>fa
            </Property>
            <Property xsi:typ
                <Name>lifeCyc
                <label>Lifecy
                <Type xsi:typ
                    <tgpType>
                </Type>
                <defaultValue
```

Based on hierarchy of platform.framework#CompositeTemplate

```
BaseGC - platform.tgp
  BaseTemplate - platform.tgp
    FrameworkTemplate - platform.framework
      CompositeTemplate - platform.framework
        AppBaseCPTemplate - app.core
        BaseCriteriaCPTemplate - platform.framework
        BaseTokenMeta - app.core
        CriterionCPTemplate - platform.framework
        DynamicCompositeTemplateMetaFieldsCPTemplate - platform.framework
        EntityTemplate - platform.framework
          ActivityLogTemplate - platform.framework
          AppEntityTemplate - app.core
            AnalyticsConfigTemplate - app.core
            AppBaseTemplate - app.core
              CDREventProcessorMeta - app.external_service
              CDRSourceMeta - app.external_service
              CatalogTemplate - app.core
                AnnouncementTemplate - app.core
                BaseItemRecommenderTemplate - app.core
                BillingCodeMappingMeta - app.core
                OfferingMeta - app.core
                  BroadcastMeta - app.business_template
                  ConditionalBenefitMeta - app.business_template
                  CouponMeta - app.business_template
                  HappyHourMeta - app.business_template
                  InvitationMeta - app.business_template
                  PurchasableOfferMeta - app.core
                  RelatedItemsMeta - app.business_template
                PricingElementMeta - app.core
                SegmentTemplate - app.core
              CategoryTemplate - app.core
              ContentItemTemplate - app.core
              CounterRecordTemplate - app.core
              ExportImportMeta - app.core
              OutgoingBenefitMeta - app.core
              QuestionnaireMeta - app.core
```

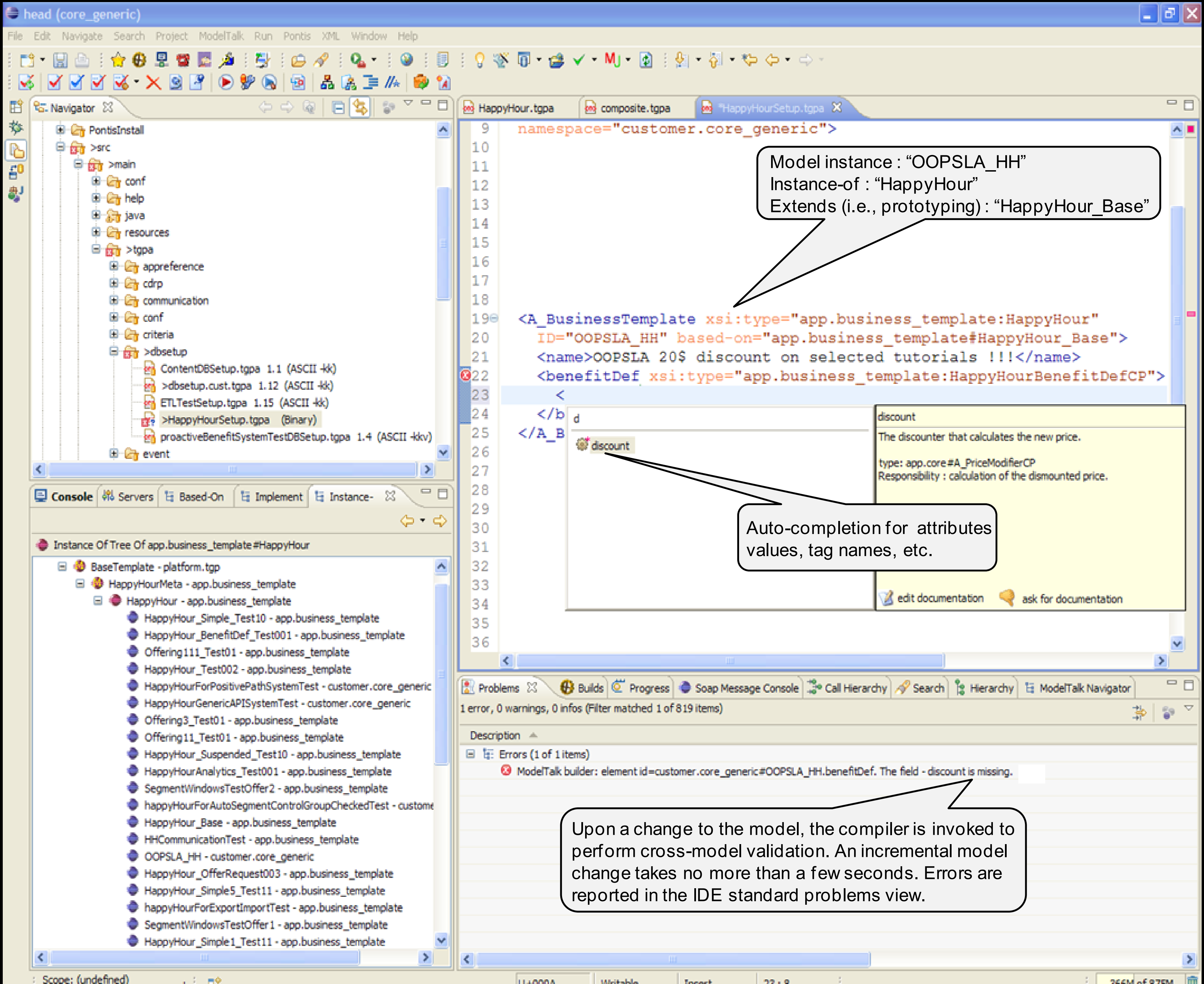
click here (or ctrl-t) to switch to tgp hierarchy

TGP Tree of platform.framework#CompositeTemplate

```
A_CompositeTemplate - platform.framework
  CompositeTemplate - platform.framework
    ActivityLogEntity - platform.framework
      ManualSegmentUploadActivityLogEntity - app.core
    AddOfferingsInputCP - app.core
    AddSubscriberIdInputCP - app.core
    AdditionalResponseCPBase - app.core
      ContentCategoriesResponseCP - app.core
    AggregatedTriggersWithEventCounterDefCP - app.core
    AggregationPeriodCP - app.core
    AggregationRecurrenceDefCP - app.core
    AggregationRecurrentEventCounterCP - app.core
    AnalyticsEnums - platform.framework
    AppBaseCPTemplate - app.core
      AdditionalResponseCPBase - app.core
        ContentCategoriesResponseCP - app.core
      AppBaseCP - app.core
        AbstractSuccessConditionsCP - app.business_t
          SuccessConditionsCP - app.business_templ
        AddOfferingsInputCP - app.core
        AdditionalResponseBase - app.external_servic
          ContentCategoriesResponse - app.externa
        AggregationPeriodCP - app.core
        AggregativeEventCP_Test001 - app.core
        AggregativeEventCP_Test002 - app.core
        AlwaysSchedule - app.core
        BIStatisticsStatusCP - app.core
        BIStatsKeyCP - app.core
```

Instance Of Tree Of platform.framework#CompositeTemplate

```
CompositeTemplate - platform.framework
  DoubleCriterionCPEquals - platform.framework
  ManualSegmentUploadInputCP - app.core
  OperationStatusCP - app.core
    OperationStatusCPDummy - app.core
  TimeIntervalReminderCriterionCP - app.core
  Recommendation - app.core
  StringCriterionCPEquals - platform.framework
  ContentItemInCategory - app.core
  UsageBaseEventCP - app.core
  RequestCriterionCP - app.core
  CompositeValue - platform.framework
  ProactiveBenefitTimedEventCP - app.core
  RecurrentSingleEventCounterCP - app.core
  CompositeDefaultValueSelectionCP - platform.ui
  SetupFeatureModel - platform.framework
  DashboardKpiManagerCP - platform.ui
  CommitRequestCP - app.core
  CSRGrantedBenefitCP - app.core
  CompositeListDefaultValueContainerCP - platforr
  EligibilityListCP - app.core
  CriterionCP - platform.framework
  CancelResponseCP - app.core
```



PontisInstall
>src
>main
conf
help
java
resources
>tgpa
appreference
cdrp
communication
conf
criteria
>dbsetup
ContentDBSetup.tgpa 1.1 (ASCII -kk)
>dbsetup.cust.tgpa 1.12 (ASCII -kk)
ETLTestSetup.tgpa 1.15 (ASCII -kk)
>HappyHourSetup.tgpa (Binary)
proactiveBenefitSystemTestDBSetup.tgpa 1.4 (ASCII -kkv)
event

```
namespace="customer.core_generic">









<A_BusinessTemplate xsi:type="app.business_template:HappyHour"
  ID="OOPSLA_HH" based-on="app.business_template#HappyHour_Base">
  <name>OOPSLA 20$ discount on selected tutorials !!!</name>
  <benefitDef xsi:type="app.business_template:HappyHourBenefitDefCP">
    <
  </b
</A_B
```

d

discount

discount

The discounter that calculates the new price.

type: app.core#A_PriceModifierCP
Responsibility : calculation of the dismounted price.

Model instance : “OOPSLA_HH”
Instance-of : “HappyHour”
Extends (i.e., prototyping) : “HappyHour_Base”

Auto-completion for attributes values, tag names, etc.

Instance Of Tree Of app.business_template#HappyHour

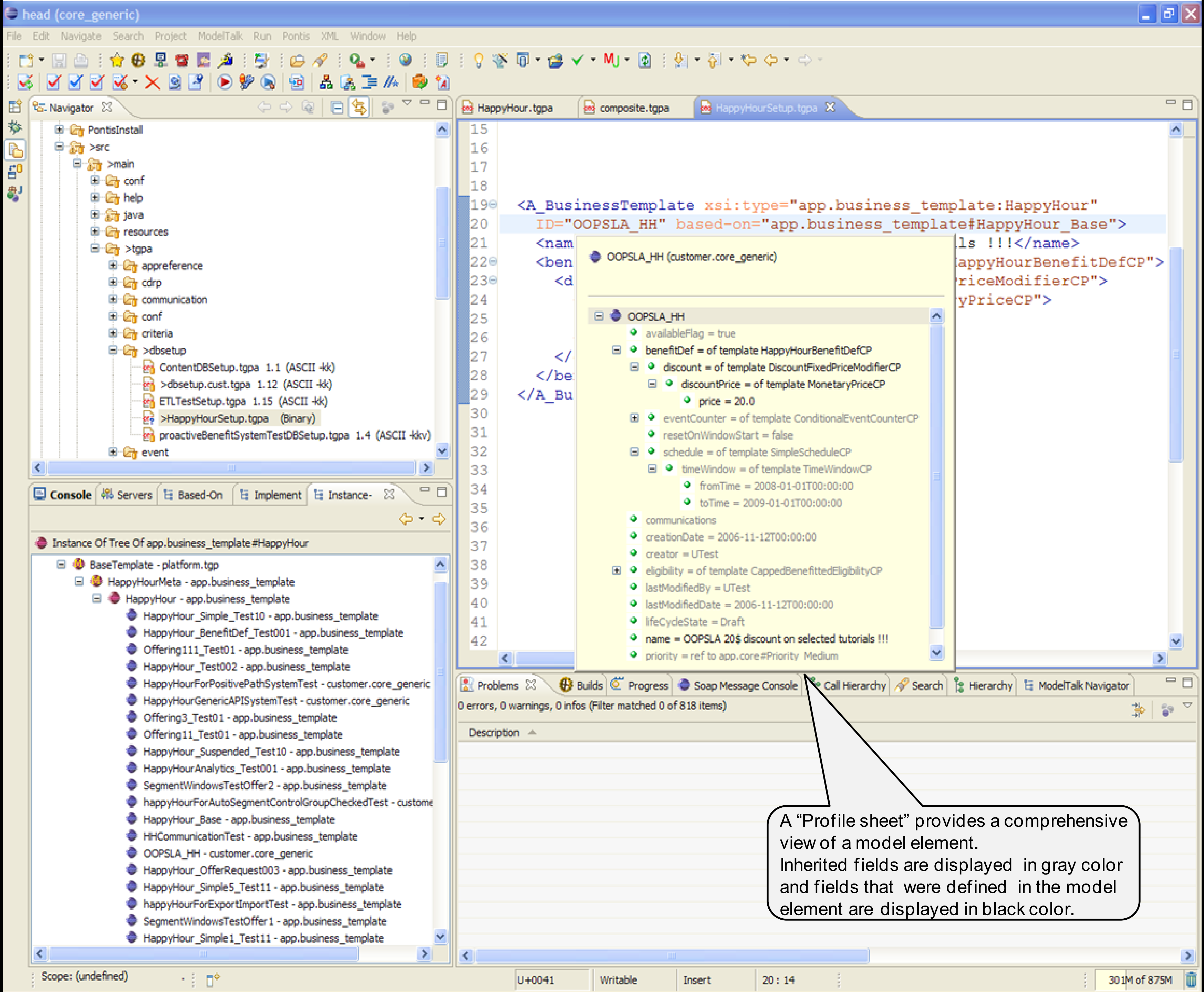
BaseTemplate - platform.tgp
HappyHourMeta - app.business_template
HappyHour - app.business_template
HappyHour_Simple_Test10 - app.business_template
HappyHour_BenefitDef_Test001 - app.business_template
Offering111_Test01 - app.business_template
HappyHour_Test002 - app.business_template
HappyHourForPositivePathSystemTest - customer.core_generic
HappyHourGenericAPISystemTest - customer.core_generic
Offering3_Test01 - app.business_template
Offering11_Test01 - app.business_template
HappyHour_Suspended_Test10 - app.business_template
HappyHourAnalytics_Test001 - app.business_template
SegmentWindowsTestOffer2 - app.business_template
happyHourForAutoSegmentControlGroupCheckedTest - custome
HappyHour_Base - app.business_template
HHCommunicationTest - app.business_template
OOPSLA_HH - customer.core_generic
HappyHour_OfferRequest003 - app.business_template
HappyHour_Simple5_Test11 - app.business_template
happyHourForExportImportTest - app.business_template
SegmentWindowsTestOffer1 - app.business_template
HappyHour_Simple1_Test11 - app.business_template

1 error, 0 warnings, 0 infos (Filter matched 1 of 819 items)

Errors (1 of 1 items)

ModelTalk builder: element id=customer.core_generic#OOPSLA_HH.benefitDef. The field - discount is missing.

Upon a change to the model, the compiler is invoked to perform cross-model validation. An incremental model change takes no more than a few seconds. Errors are reported in the IDE standard problems view.



```
PontisInstall
  >src
    >main
      conf
      help
      java
      resources
      >tgpa
        appreference
        cdrp
        communication
        conf
        criteria
        >dbsetup
          ContentDBSetup.tgpa  1.1  (ASCII -kk)
          >dbsetup.cust.tgpa  1.12  (ASCII -kk)
          ETLTestSetup.tgpa  1.15  (ASCII -kk)
          >HappyHourSetup.tgpa   (Binary)
          proactiveBenefitSystemTestDBSetup.tgpa  1.4  (ASCII -kkv)
        event
```

```
<A_BusinessTemplate xsi:type="app.business_template:HappyHour"
  ID="OOPSLA_HH" based-on="app.business_template#HappyHour_Base">
  <nam                                   ls !!!</name>
  <ben                                   appyHourBenefitDefCP">
    <d                                   riceModifierCP">
                                         yPriceCP">


    </
  </be
</A_Bu
```

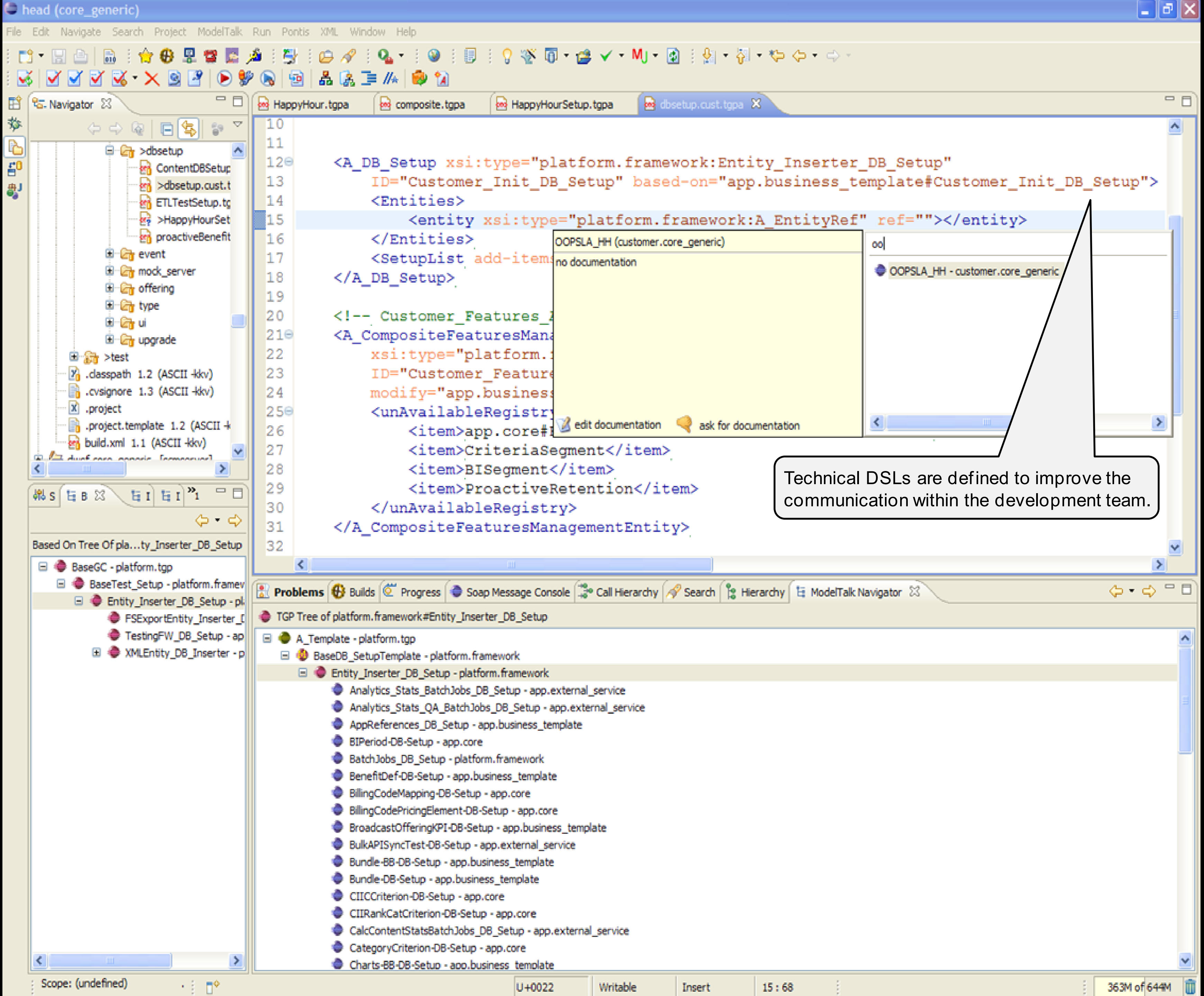
```
OOPSLA_HH (customer.core_generic)

OOPSLA_HH
  availableFlag = true
  benefitDef = of template HappyHourBenefitDefCP
    discount = of template DiscountFixedPriceModifierCP
      discountPrice = of template MonetaryPriceCP
        price = 20.0
    eventCounter = of template ConditionalEventCounterCP
    resetOnWindowStart = false
    schedule = of template SimpleScheduleCP
      timeWindow = of template TimeWindowCP
        fromTime = 2008-01-01T00:00:00
        toTime = 2009-01-01T00:00:00
  communications
  creationDate = 2006-11-12T00:00:00
  creator = UTest
  eligibility = of template CappedBenefittedEligibilityCP
  lastModifiedBy = UTest
  lastModifiedDate = 2006-11-12T00:00:00
  lifeCycleState = Draft
  name = OOPSLA 20$ discount on selected tutorials !!!
  priority = ref to app.core#Priority_Medium
```

```
Instance Of Tree Of app.business_template#HappyHour
  BaseTemplate - platform.tgp
    HappyHourMeta - app.business_template
      HappyHour - app.business_template
        HappyHour_Simple_Test10 - app.business_template
        HappyHour_BenefitDef_Test001 - app.business_template
        Offering111_Test01 - app.business_template
        HappyHour_Test002 - app.business_template
        HappyHourForPositivePathSystemTest - customer.core_generic
        HappyHourGenericAPISystemTest - customer.core_generic
        Offering3_Test01 - app.business_template
        Offering11_Test01 - app.business_template
        HappyHour_Suspended_Test10 - app.business_template
        HappyHourAnalytics_Test001 - app.business_template
        SegmentWindowsTestOffer2 - app.business_template
        happyHourForAutoSegmentControlGroupCheckedTest - custome
        HappyHour_Base - app.business_template
        HHCommunicationTest - app.business_template
        OOPSLA_HH - customer.core_generic
        HappyHour_OfferRequest003 - app.business_template
        HappyHour_Simple5_Test11 - app.business_template
        happyHourForExportImportTest - app.business_template
        SegmentWindowsTestOffer1 - app.business_template
        HappyHour_Simple1_Test11 - app.business_template
```

0 errors, 0 warnings, 0 infos (Filter matched 0 of 818 items)

Scope: (undefined)   U+0041   Writable   Insert   20 : 14   301M of 875M

A “Profile sheet” provides a comprehensive view of a model element.
Inherited fields are displayed in gray color and fields that were defined in the model element are displayed in black color.



- >dbsetup
  - ContentDBSetup
  - >dbsetup.cust.t
  - ETLTestSetup.tg
  - >HappyHourSet
  - proactiveBenefit
- event
- mock_server
- offering
- type
- ui
- upgrade
- >test
- .classpath 1.2 (ASCII -kkv)
- .cvsignore 1.3 (ASCII -kkv)
- .project
- .project.template 1.2 (ASCII -k
- build.xml 1.1 (ASCII -kkv)

```
<A_DB_Setup xsi:type="platform.framework:Entity_Inserter_DB_Setup"
    ID="Customer_Init_DB_Setup" based-on="app.business_template#Customer_Init_DB_Setup">
    <Entities>
        <entity xsi:type="platform.framework:A_EntityRef" ref=""></entity>
    </Entities>
    <SetupList add-items
</A_DB_Setup>

<!-- Customer_Features_
<A_CompositeFeaturesMana
    xsi:type="platform.
    ID="Customer_Feature
    modify="app.busines
    <unAvailableRegistry
        <item>app.core#
        <item>CriteriaSegment</item>
        <item>BISegment</item>
        <item>ProactiveRetention</item>
    </unAvailableRegistry>
</A_CompositeFeaturesManagementEntity>
```

OOPSLA_HH (customer.core_generic)

no documentation

edit documentation ask for documentation

oo

OOPSLA_HH - customer.core_generic

Technical DSLs are defined to improve the communication within the development team.

Based On Tree Of pla...ty_Inserter_DB_Setup

- BaseGC - platform.tgp
  - BaseTest_Setup - platform.framew
    - Entity_Inserter_DB_Setup - pl
      - FSExportEntity_Inserter_[
      - TestingFW_DB_Setup - ap
      - XMLEntity_DB_Inserter - p

TGP Tree of platform.framework#Entity_Inserter_DB_Setup

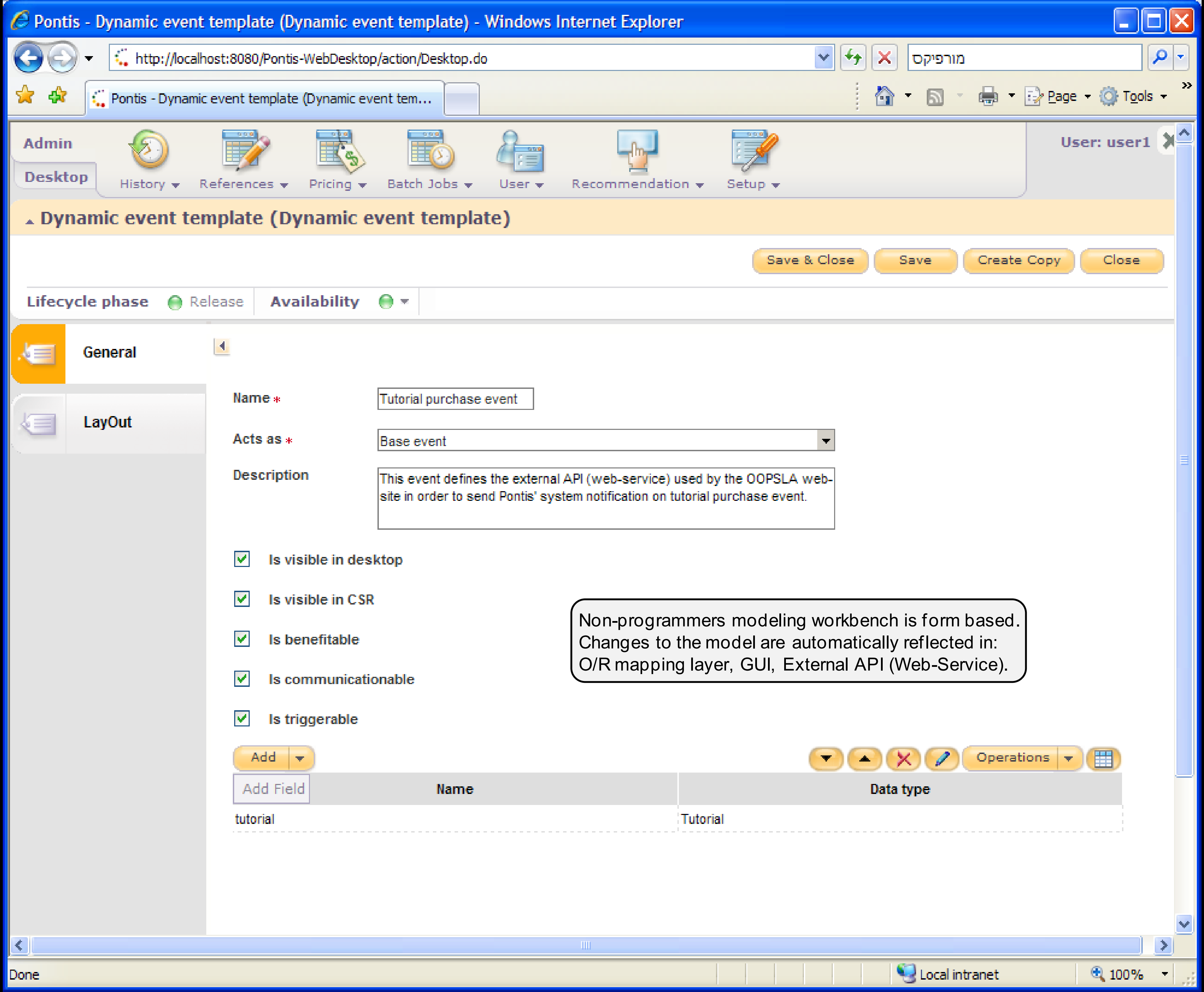
- A_Template - platform.tgp
  - BaseDB_SetupTemplate - platform.framework
    - Entity_Inserter_DB_Setup - platform.framework
      - Analytics_Stats_BatchJobs_DB_Setup - app.external_service
      - Analytics_Stats_QA_BatchJobs_DB_Setup - app.external_service
      - AppReferences_DB_Setup - app.business_template
      - BIPeriod-DB-Setup - app.core
      - BatchJobs_DB_Setup - platform.framework
      - BenefitDef-DB-Setup - app.business_template
      - BillingCodeMapping-DB-Setup - app.core
      - BillingCodePricingElement-DB-Setup - app.core
      - BroadcastOfferingKPI-DB-Setup - app.business_template
      - BulkAPISyncTest-DB-Setup - app.external_service
      - Bundle-BB-DB-Setup - app.business_template
      - Bundle-DB-Setup - app.business_template
      - CIICCriterion-DB-Setup - app.core
      - CIIRankCatCriterion-DB-Setup - app.core
      - CalcContentStatsBatchJobs_DB_Setup - app.external_service
      - CategoryCriterion-DB-Setup - app.core
      - Charts-BB-DB-Setup - app.business_template

Demo: Edit-Execute Cycle (2/2)

Part II: The Non-Programmer Perspective

- Create new reference code Tutorial in the GUI
- Create new OOPSLA event Tutorial purchase Event in the GUI
- Send an event to the Pontis system and receive a discount

Model VM → Runtime modeling capabilities
Interpretive → Short cycle



Pontis - Dynamic event template (Dynamic event template) - Windows Internet Explorer
http://localhost:8080/Pontis-WebDesktop/action/Desktop.do
מורפיקס
Pontis - Dynamic event template (Dynamic event tem...
Page
Tools
Admin
Desktop
History
References
Pricing
Batch Jobs
User
Recommendation
Setup
User: user1
Save & Close
Save
Create Copy
Close
General
LayOut
Add
Operations
Add Field
Done
Local intranet
100%

Dynamic event template (Dynamic event template)

Lifecycle phase ● Release | Availability ●

Name *	Tutorial purchase event
Acts as *	Base event
Description	This event defines the external API (web-service) used by the OOPSLA web-site in order to send Pontis' system notification on tutorial purchase event.

☑ Is visible in desktop

☑ Is visible in CSR

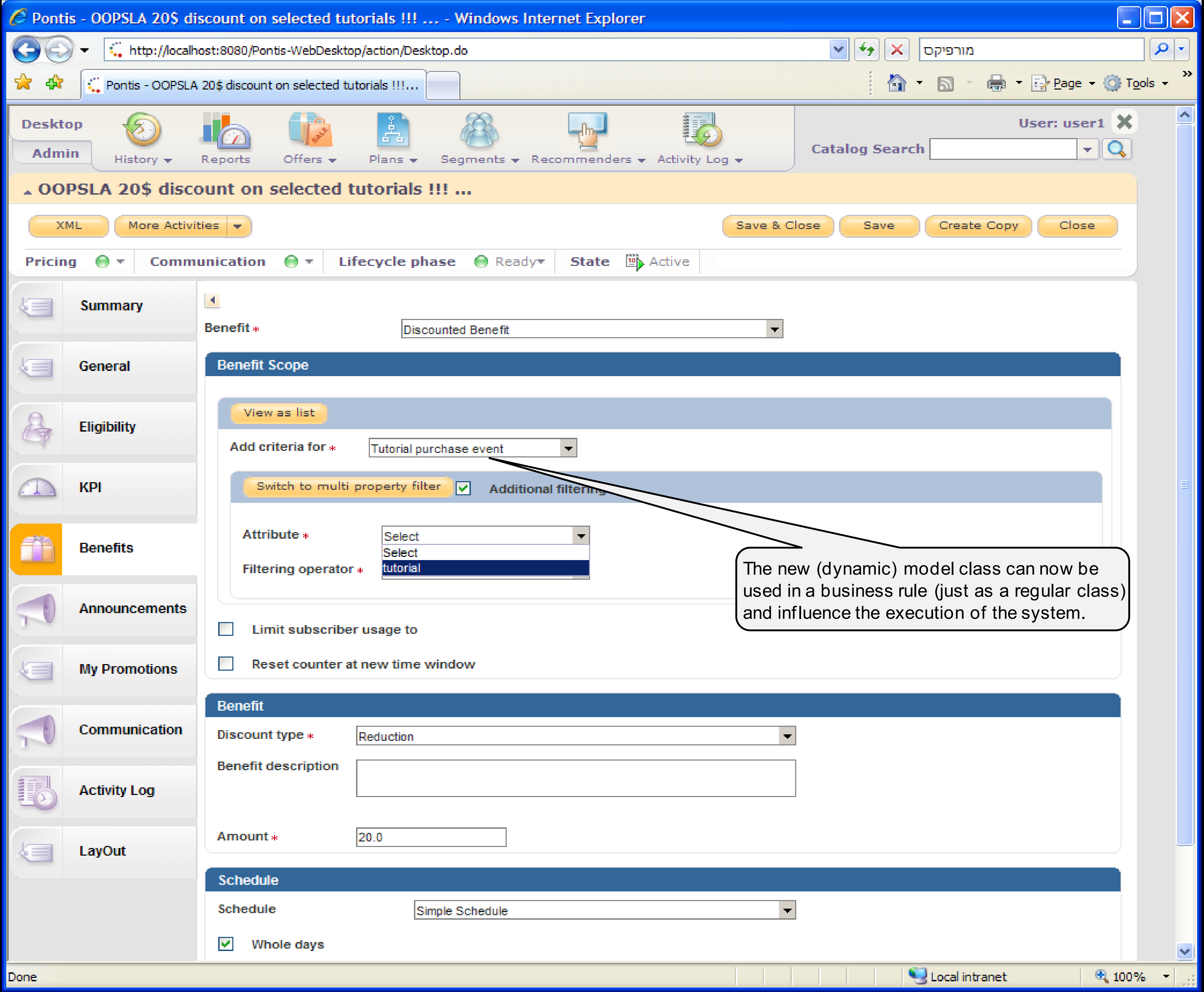
☑ Is benefitable

☑ Is communicationable

☑ Is triggerable

Name	Data type
tutorial	Tutorial

Non-programmers modeling workbench is form based.
Changes to the model are automatically reflected in:
O/R mapping layer, GUI, External API (Web-Service).



OOPSLA 20$ discount on selected tutorials !!! ...

Pricing ● | Communication ● | Lifecycle phase ● Ready | State Active

Benefit * Discounted Benefit

Benefit Scope

Add criteria for * Tutorial purchase event

☑ Additional filtering

Attribute * Select

Select
tutorial

Filtering operator *

□ Limit subscriber usage to

□ Reset counter at new time window

Benefit

Discount type * Reduction

Benefit description

Amount * 20.0

Schedule

Schedule Simple Schedule

☑ Whole days

The new (dynamic) model class can now be used in a business rule (just as a regular class) and influence the execution of the system.

Conclusion

ModelTalk = MDD + Dependency Injection + Meta-modeling

- ModelTalk integrates MDD, Dependency Injection and Meta-Modeling to form an interpretive, Domain Specific Modeling framework.

Thank You

ModelTalk: A Framework for Developing Domain Specific Executable Models

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