

Internet application development using a meta-repository

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Introduction



- **Application requirements**
 - **Configurable, flexible, adaptable**
 - **'End-user' 'programmable'**
- **No hard-coding of model and business rules**
 - **Dynamic**
- **High-level**
 - **Domain-specific languages**
- **Metadata**
 - **Self-description**

Dynamic Object Models

- **A system with a dynamic object model has an explicit object model that it interprets at run-time. If you change the object model, the system changes its behavior.**
- **The model defines the objects, their states, the events, and the conditions under which an object changes state.**
- **Business rules can be stored in a dynamic object model that makes it easy to evolve the way a company does their business.**

Business application framework

■ Goal

■ End-user applications

- | Databases, electronic documents, workflow
 - Client / server + Internet
- | Common business model

■ Flexible application development framework

■ Subject to change by 'end-user'

■ Business model

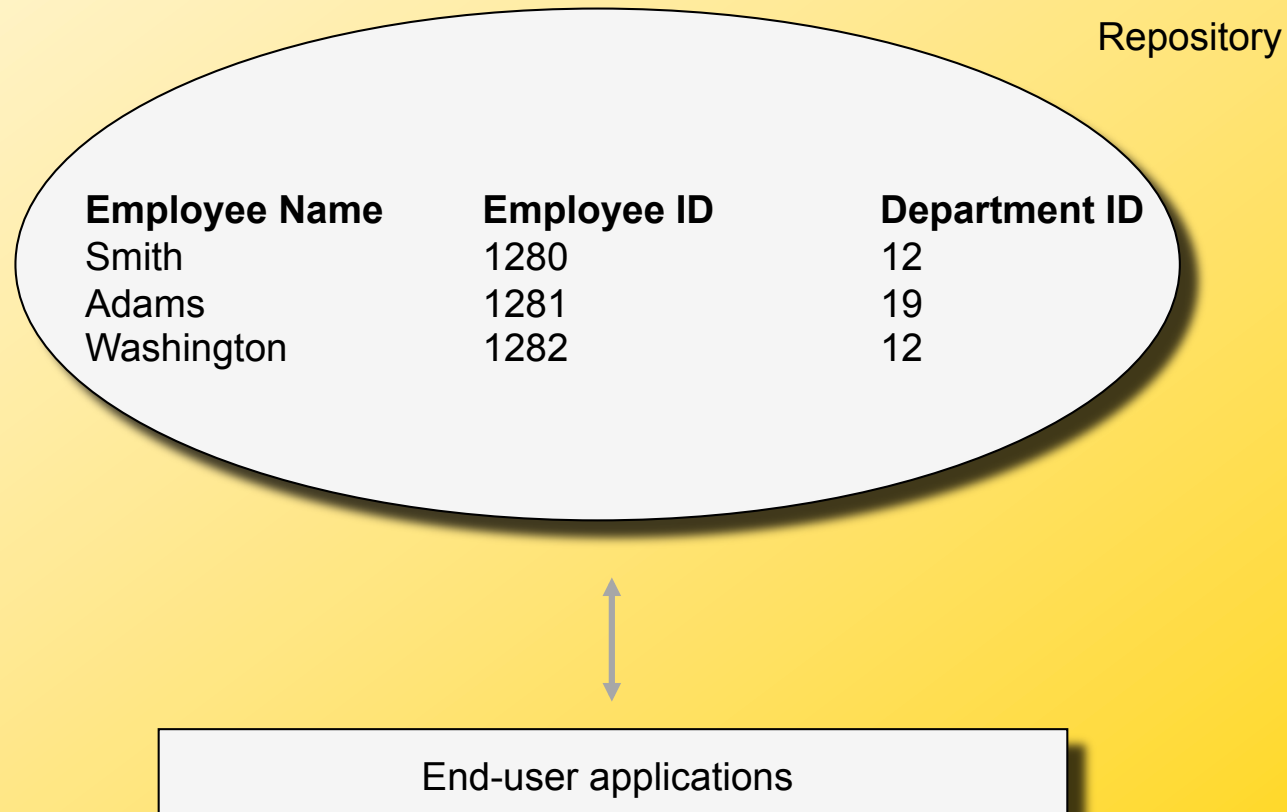
- | Organization model, object model, business rules, ...

■ Application specifications

- | Overview lists, forms, query screens, ...

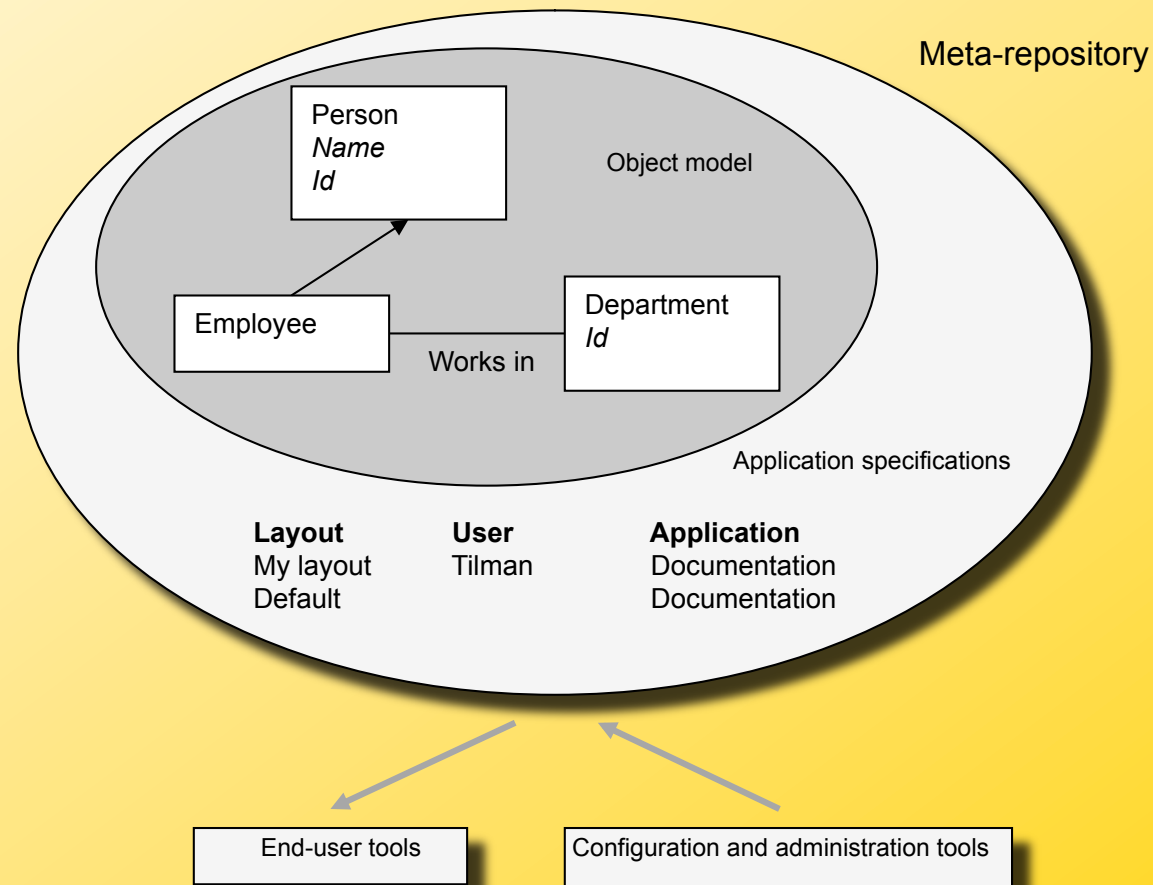
Approach

Traditional data repository



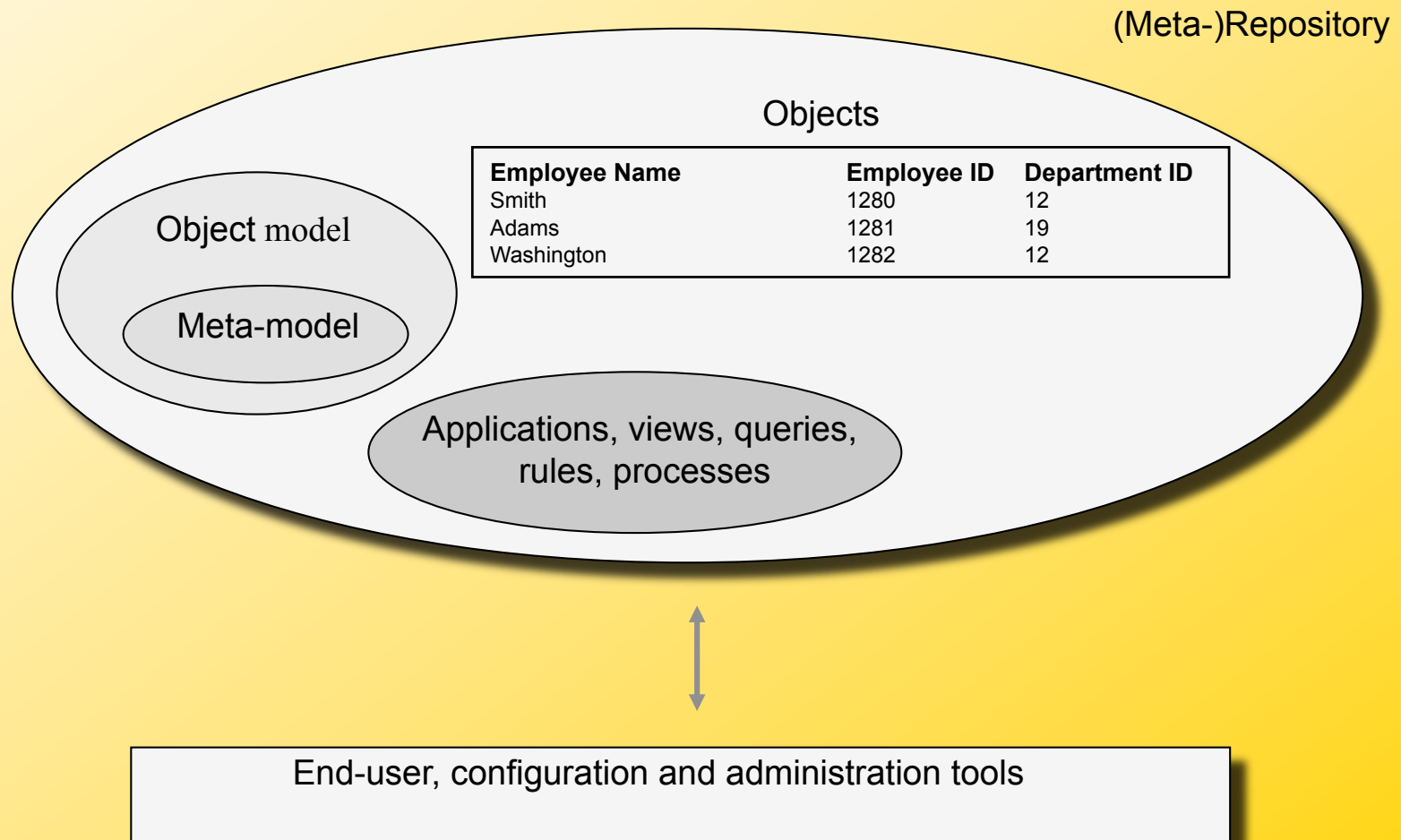
Approach

Adding meta-repository



Approach

Combining repositories



Building applications



- **Define or extend object model**
 - Object types, associations and basic constraints
- **Define application environment**
 - Views on shared object model
- **Business rules**
 - Authorizations, user-defined constraints, event-condition-action rules, workflow processes
- **Object behavior**

Building Internet applications

- **Re-use existing framework**
 - Application environment, queries, layouts, business rules, ...
- **Internet server**
 - **Framework client**
 - **4-Tier architecture**
 - Browser - HTTP server - Internet server - DB
 - **Orthogonal application view**

Demo

Object model and application editors

The screenshot displays a Windows desktop environment with several application windows open. The desktop background is a dark, abstract image. On the left side, the taskbar shows icons for 'My Computer', 'Network Neighborhood', 'My Briefcase', 'Recycle Bin', 'My Documents', 'Internet Explorer', and 'Outlook Express'. A 'Launch pad' window is also visible in the bottom-left corner, showing 'Active applications' with '1 - Object Model Editor' listed.

The main focus is on three overlapping windows:

- 1 - Object Model Editor:** This window shows a hierarchical tree view of object types. The 'Documentatie' folder is expanded, showing sub-objects like 'Tekst', 'Uitgave', 'Aanvulwerk', 'Boeken, Brochures, Rappo', and 'Tijdschrift-editie'. A table below the tree lists these objects with their 'Concrete' status.
- Form: MMObject Type [Documentatie]:** This window displays the 'Object Type - Summary' for 'Documentatie'. It includes fields for 'Name' (Documentatie), 'Comment' (gemeenschappelijke root van documentatie in kader documentatiediensten etc.), 'Supertype' (Workflow Gegeven), and a 'Properties' list. The 'Properties' list includes 'Naam', 'Type', 'Abstract', 'Auteurs', 'Gerelateerd aan', 'Opmerking!', 'Publicatiedatum', and 'Relaties met'.
- Application editor:** This window shows a list of 'Object types' and 'Properties'. The 'Object types' list includes 'Aanvulwerk (Uitgave)', 'Aard', 'Association Type Specification', 'Auteur', 'Boeken, Brochures, Rapporten (Uitgave)', 'Cel (Organisatorische eenheid)', 'Cel categorie', 'Column', 'Distributielijst', 'Documentatie (Workflow Gegeven)', 'Documentatieverzameling', 'Doelgroepen', 'Exemplaar', and 'FwEncodedValue'. The 'Properties' list includes 'Abstract', 'Auteurs (Auteur)', 'Gerelateerd aan (Documentatie)', 'Opmerking!', 'Publicatiedatum', 'Relaties met (Documentatie)', and 'Titel'. There are also checkboxes for 'Query', 'Create', 'Read-only', and 'Create directly'.

Demo

Fully functional default application

The screenshot displays a Windows desktop environment with several open applications. On the left, the Start menu is visible with icons for My Computer, Network Neighborhood, My Briefcase, Recycle Bin, My Documents, Internet Explorer, Outlook Express, and Launch pad. The desktop background is a dark, textured image.

The main window is a document editor titled "Documentatie internet". It has a menu bar (File, Edit, Query, List, Extra, View, Window, Help) and a toolbar. The document content is a form titled "Form: Tekst (Feestdag van de Vlaamse Gemeenschap.)". The form fields include:

- Titel: is
- Datum Invoer
- Datum Wijziging
- Abstract
- Opmerking
- Publicatiedatum
- Titel
- Wijziger
- Abstract
- Auteurs
- Publicatiedatum
- Relaties met
- Titel: Feestdag van de Vlaamse Gemeenschap.
- Aard
- Document: PLoP2000.pdf

The right window is a PDF reader titled "Reader - [000001 - pdf]". It displays a document titled "Dynamic Object Model" by Dirk Riehle. The document content includes:

Dynamic Object Model

Dirk Riehle
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1 Intent and Summary

Provide a framework that lets you dynamically define a domain object model at runtime.

The framework forms a metamodel that lets you model issues such as object properties, object relationships (like aggregation or role playing) and class relationships (like inheritance) at runtime. Using the framework, you can introduce a new domain model or change an existing one anytime you want, giving you (near) zero time-delay between conceiving a domain model and running it on a computer. Effectively, the framework represents a domain-specific modeling language.

Dynamic Object Model is a compound pattern¹ that at its core composes the Type Object, Property List, and Value Holder patterns.

2 Also Known As

Type Square, Object System, Runtime Domain Model, Active Object Model.

3 Motivation

Imagine you are developing a banking system for handling customer accounts like checking or savings accounts. You first think about a nice class hierarchy of account classes, starting with a root class Account. However, your domain experience tells you that banks provide many different types of accounts. It is not uncommon for a large bank to provide more than 500 types of accounts as products to their clients. Many of these accounts vary only by a few parameters, but they are still distinct enough to require modeling these distinctions.

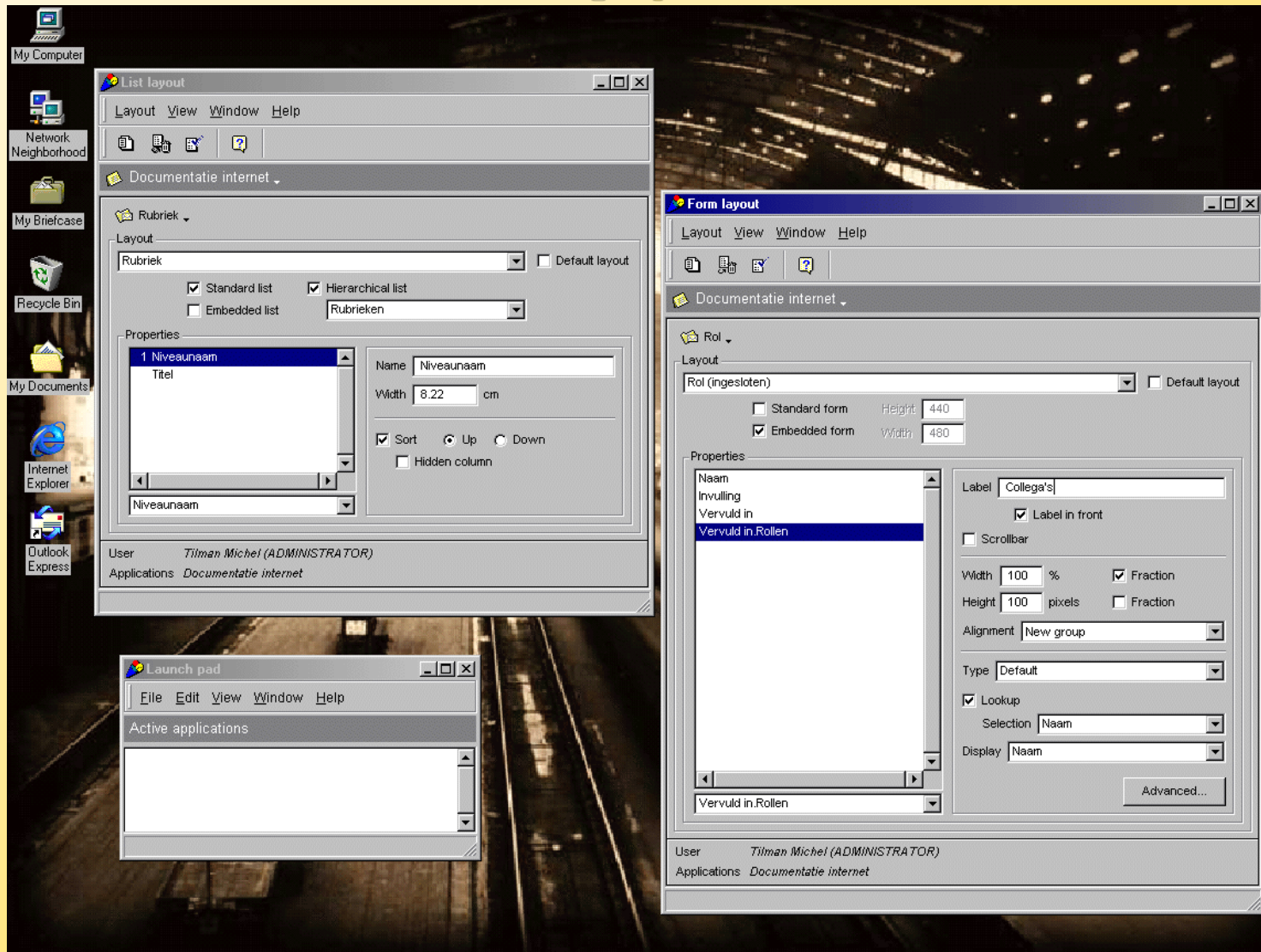
You quickly give up modeling 500 Account classes. Remembering the Type Object pattern [Johnson+1998] you decide to introduce a class AccountType whose instances represent a specific type of account, and a class Account

¹ A compound pattern is a pattern that is best described as a recurring composition of other patterns. It was originally called "composite pattern" [Riehle+1997a], but John Vlissides convinced us to rename the concept "compound pattern" to avoid confusion [Vlissides+1998].

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Demo

Customizing default application



Demo

Configuring Internet application

The screenshot displays a Windows desktop environment with several open windows:

- Launch pad:** A window showing active applications, with 'Internet beheer' listed.
- Internet beheer:** A window displaying a tree view of document categories. The selected category is 'Handelingen Plenaire en Commissievergaderingen Vlaams Parlement'.
- Query: "HAND VL PARL PL+COM-internet":** A window showing search criteria and a table of results.

The search criteria in the 'Query' window are:

- Titel is []
- Trefwoorden.Naam is []
- Trefwoorden.Naam is []
- Tekstdatum = []
- Nr is []
- Soort = [] (Handelingen Plenaire Vergadering Vlaams Par)
- Soort = [] (Handelingen Openbare Commissievergadering)

The table of results shows the following data:

Tekstdatum	Nr	Titel
6-5-1998	-	Interpellatie van mevrouw Patricia Ceysens tot de heer Luc Van den Brande, minist
5-5-1998	-	Interpellatie van mevrouw Riet Van Cleuvenbergen tot de heer Luc Van den Bossc
30-4-1998	-	Interpellatie van mevrouw Cecile Verwimp-Sillis tot de heer Luc Van den Bossche,
29-4-1998	-	Voorstel van decreet van de heer Marc Olivier c.s. houdende wijziging van het dec
29-4-1998	-	Voorstel van decreet van de heer Marc Olivier c.s. houdende wijziging van het dec

The 'Form: FwNode (Handelingen Plenaire en Commissievergaderin...)' window shows the following configuration:

- Name: Handelingen Plenaire en Commissievergaderingen Vlaams Parleme
- Open by default: Yes No
- Tree: Documentatie internet
- Parent: Parlementaire documenten
- Children: []
- Query: HAND VL PARL PL+COM-internet

Demo

Internet query screen

Available information

- Documentatie internet
 - Algemene zoekopdracht
 - Boeken, brochures, rapporten
 - Omzendbrieven
 - Codificaties inzake personeel en algemene zaken van het Ministerie van Financien
 - Coördinatie van de omzendbrieven
 - Kaderblad
 - Vademecum van de Vlaamse regering
 - Parlementaire documenten
 - Beknopt Verslag Vlaams Parlement
 - Handelingen Plenaire en Commissievergaderingen Vlaams Parlement
 - Stukken Vlaams Parlement
 - Vragen & Antwoorden
 - Tijdschriftartikelen
 - Wet., decreet-, en regelgeving, rechtspraak

Problems? Contact [Webmaster](#).

Query - Handelingen Plenaire en Commissievergaderingen Vlaams Parlement

Titel: Elements at a time: Sort by:

Trefwoord 1:

Trefwoord 2:

Tekstdatum:

Nr:

Results 1 - 12

Tekstdatum	Nr	Titel
4/29/98	-	Voorstel van decreet van de heer Marc Olivier c.s. houdende wijziging van het decreet van 23 december 1986 houdende de integratie van de kunstwerken in gebouwen van openbare diensten en daame gelijk-gestelde diensten en van door de overheid gesubsidieerde inrichtingen, verenigingen en diensten die tot de Vlaamse Gemeenschap behoren - 891 (1997-1998) - Nrs. 1 tot 3 Hoofdelijke stemming
4/29/98	-	Voorstel van decreet van de heer Marc Olivier c.s. houdende wijziging van het decreet van 23 december 1986 houdende de integratie van de kunstwerken in gebouwen van openbare diensten en daame gelijk-gestelde diensten en van door de overheid gesubsidieerde inrichtingen, verenigingen en diensten die tot het Vlaamse Gewest behoren - 892 (1997-1998) - Nrs. 1 tot 3 Hoofdelijke stemming
4/1/98	-	Voorstel van resolutie van mevrouw Yolande Avontroodt, mevrouw Trees Merckx-Van Goey en de heer Guy Swennen betreffende het optimaal inschakelen van de MST-PMS-centra bij de drugspreventie - 930 (1997-1998) - Nrs. 1 tot 4 Aangehouden stemmings Spreker : de heer Felix Strackx Hoofdelijke stemming
3/31/98	-	Voorstel van resolutie van mevrouw Yolande Avontroodt, mevrouw Trees Merckx-Van Goey en de heer Guy Swennen betreffende het optimaal inschakelen van de MST-PMS-centra bij de drugspreventie. - 930 (1997-1998) - Nrs. 1 tot 4 Voorstel van resolutie van de heren Felix Strackx en Frank Creyelman betreffende het terugdringen van het drugsgebruik bij de schoolgaande jeugd in Vlaanderen - 924 (1997-1998) - Nrs. 1 en 2 Bespreking Sprekers : mevrouw Kathleen Helsen, verslaggever, de heer Felix Strackx, mevrouw Trees Merckx-Van Goey, mevrouw Yolande Avontroodt, de heer Herman De Reuse en minister Wivina Demeester-De Meyer
1/28/98	-	Voorstel van resolutie van de heren Gilbert Vanleenhove, Karel De Gucht, André Van Nieuwkerke, Chris Vandenbroeke, Ludo Sannen en Jos De Mever

Design



- **4-Tier architecture**
- **Partial use of VisualWave**
 - **Session management**
 - **HTTP / CGI interface**
- **SAV-triad**
 - **Session (resolver)**
 - **Application model**
 - **View**

Design

- **Session resolver identifies**

- **Application (id)**
- **Message**
 - **Registered, typed arguments**

- **Application**

- **Main application id**
- **Subcomponent**
 - **Access path**

Design



■ View

■ Generates Web page

■ HTML / Javascript

- Compatibility
- Event handlers generated dynamically at client site

■ Document builder

■ XML document

■ Avoids syntactic errors

Future directions



- **Regeneration of session context**
 - **Bookmarks**
- **SOAP-compatible message protocol**
- **Applets**
- **True XML documents**
 - **XSL**

References



■ Argo framework

- <http://users.pandora.be/michel.tilman/Publications/Wiley/Af1179.doc>
- <http://users.pandora.be/michel.tilman/Publications/Wiley/figures.zip>

■ Dynamic object models

- <http://st-www.cs.uiuc.edu/users/johnson/DOM.html>
- <http://users.pandora.be/michel.tilman/Publications/PLoP2000.pdf>