OO ABL - Design Pattern

Presentation and discussion of seven common OO Design Pattern in the context of OO ABL.

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IAP Fact Sheet

- Progress work experience since 1989
  - Company founded 1992 in Hamburg, Germany
  - Long term customer relations (since 1992)
  - 35+ staff members
- Fields of work – 80% Progress
  - Consulting, technology transfer, staff service
  - OF-1 Low Code Plattform (since 2005)
  - Tools4Progress (Viper, PCase, Skin-Client)
  - Service Delivery Partner (SDP) – Elite Level

Design Pattern

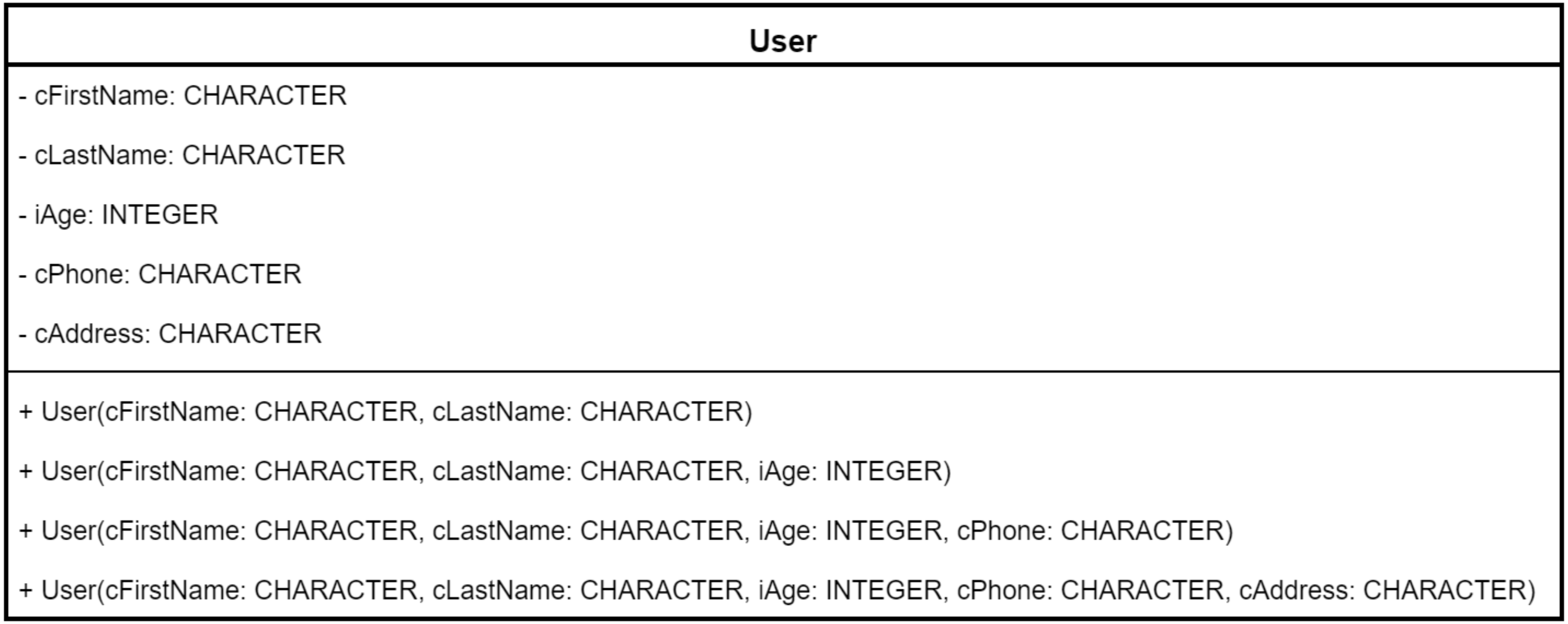
- „In software engineering, a software design pattern is a general, reusable solution to a commonly occurring problem within a given context in software design.“ -Wikipedia
- Design Patterns: Elements of reusable object-oriented software
- Three Types:
  - Creational Pattern
  - Struktural Pattern
  - Behavioral Pattern
- 23 main pattern by 'GoF' (Gang of Four)

Pattern 1: Builder

- Type: Creational Pattern
- Use one object to prepare the creation of another object
- Use if the constructor has a lot of parameter
- Why use it?
  - More readable
  - Parameter are type save and named
  - Auto-Complete
  - Simple add parameter later

Pattern 1: Builder

Initial situation – Multiple constructors



```
User
- cFirstName: CHARACTER
- cLastName: CHARACTER
- iAge: INTEGER
- cPhone: CHARACTER
- cAddress: CHARACTER
+ User(cFirstName: CHARACTER, cLastName: CHARACTER)
+ User(cFirstName: CHARACTER, cLastName: CHARACTER, iAge: INTEGER)
+ User(cFirstName: CHARACTER, cLastName: CHARACTER, iAge: INTEGER, cPhone: CHARACTER)
+ User(cFirstName: CHARACTER, cLastName: CHARACTER, iAge: INTEGER, cPhone: CHARACTER, cAddress: CHARACTER)
```

Pattern 1: Builder

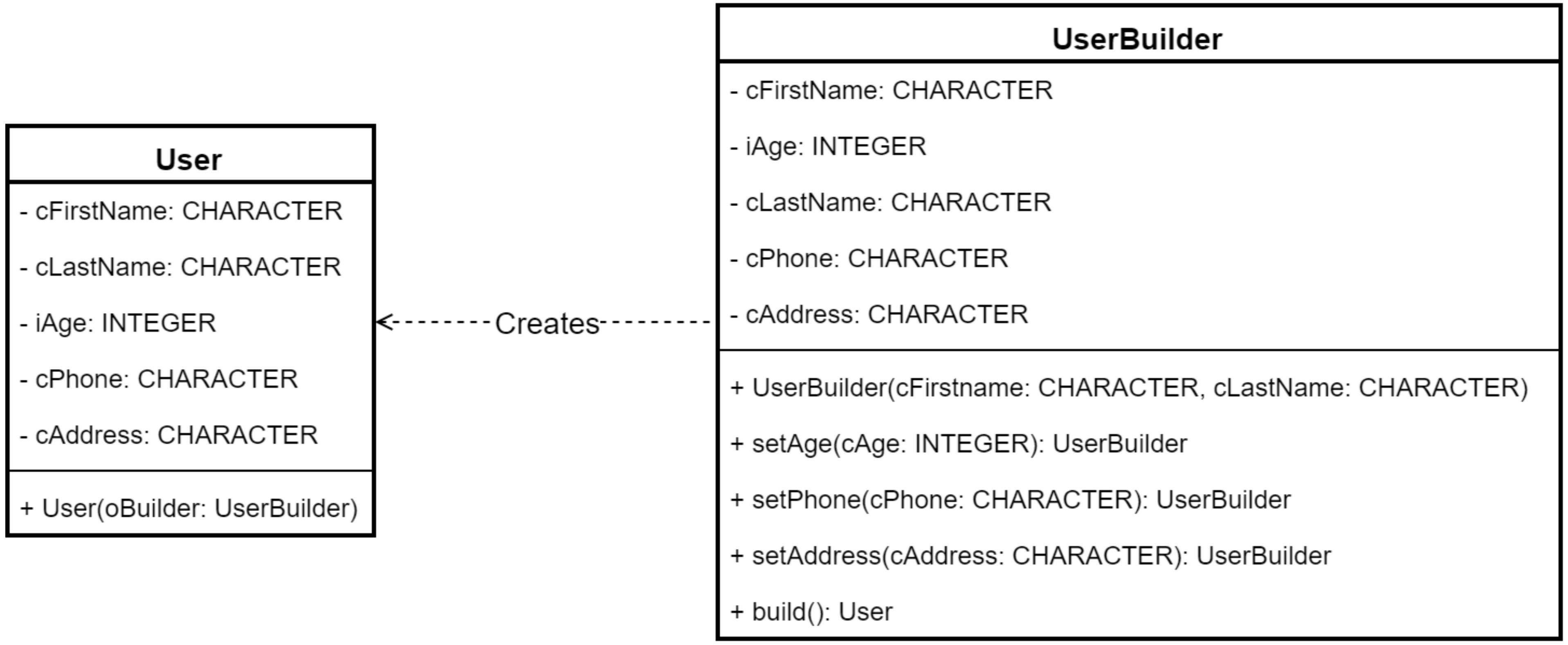
Initial code with a lot of parameters:

```
DEFINE VARIABLE oUser AS User NO-UNDO.

oUser = NEW User(
  "Una",
  "Person",
  23,
  "+49 40-30 68 03-26",
  "Valentinskamp 30, 20355 Hamburg"
).
```

Pattern 1: Builder

With Builder Pattern:



Pattern 1: Builder

Builder – part of a setter:

```
CLASS UserBuilder:
…
  METHOD PUBLIC UserBuilder setAge(iAge AS INTEGER):
    THIS-OBJECT:iAge = iAge.
    RETURN THIS-OBJECT.
  END METHOD.
…
END CLASS.
```

Pattern 1: Builder

Builder call:

```
DEFINE VARIABLE oUser AS User NO-UNDO.
oUser =
  (NEW UserBuilder("Una", "Person")
  :setAge(23)
  :setPhone("+49 40-30 68 03-26")
  :setAddress("Valentinskamp 30, 20355 Hamburg")
  :build()).
```

Pattern 1: Builder

In part:

```
RUN StatusCreate IN l-Import-Library-
Handle
  ( INPUT   l-DB-Cust,

    INPUT   "",

    INPUT   150,
...
    INPUT
      "QtyType=" + OrderQtyQualifier
    + "{&T}"
      + "UTCTime=" + l-UTCTime
      + "{&T}"
      + "ConC-ID=" + SSCO-Ord.ConC-ID
...
) NO-ERROR.
```

Real wold example with

extreme number of parameters:

```
RUN StatusCreate IN l-Import-Library-Handle
  ( INPUT   l-DB-Cust,                    /* Cust Code */
    INPUT   "",                           /* Cnee Code */
    INPUT   150,                          /* status numeric */
  /* tb, 100304; export 8645 with O-E instead of O-I */
  &IF ("{&Exp_8645_with_O-E_v1}") = "TRUE" &THEN
    INPUT   "CreateNewRep2" + SSCO-Ord.OrderType + ",StartOrderExport665",  /* Create report flag */
  &ELSE
    INPUT   "CreateNewRep" + SSCO-Ord.OrderType + ",StartOrderExport665",  /* Create report flag */
  &ENDIF
    INPUT   TRUE,                         /* Report NEW = YES */
    INPUT   SSCO-o-Movement.Movement-ID, /* NOT Ord-ID */
    INPUT   "O",                          /* Status Type */
    INPUT   0,                            /* Suborder Number */
    INPUT   0,                            /* ? */
    INPUT   l-StatusDate,                 /* Status Date */
    INPUT   l-StatusTime,                 /* Status Time */
  /* tb, 050801 */
    INPUT   "Customer EDI",            /* User Code */
    INPUT   FALSE,                        /* Print 1 */
    INPUT   FALSE,                        /* Print 2 */
    INPUT   ?,                            /* default is Today */
    INPUT   "",                           /* Remarks */
    INPUT   SSCO-Ord.OrdQty,              /* Qty */
    INPUT   0,                            /* info code */
    INPUT   SSCO-Ord.Send-ID,             /* Send-ID */
    INPUT   SSCO-Ord.Send-Code,           /* Send-Code */
    /* no transmission to CIEL for Road orderlines */
    &IF ("{&Road_Order}") = "TRUE" &THEN
    INPUT   (SSCO-Ord.TrnsType-Code <> "R" AND b-Cust.Released), /* IsTransmit */
    &ELSE
    INPUT   b-Cust.Released,              /* IsTransmit */
    &ENDIF
    INPUT   l-Import-Date-asDate,         /* created on */
    INPUT   l-Import-Time-asChar,         /* time on */
    INPUT   "",                           /* knref */
    INPUT   "",                           /* damaged code */
    INPUT   "",                           /* address type-code */
    INPUT   ?,                            /* docs delivery date */
    INPUT   "",                           /* docs delivery time */
    INPUT   0,                            /* invoice header ID */
    INPUT   TRUE,                         /* check for duplicate status ? */
    INPUT   "",                           /* Reason Code */
    INPUT   "",                           /* Export/Import Flag */
    INPUT   "",                           /* SubStatus */
    INPUT   "QtyType=" + l-tt-{&ShipType}660.OrderQtyQualifier        + "{&T}" +
            "UTCTime=" + l-UTCTime                                    + "{&T}" +
            "ConC-ID=" + STRING(SSCO-Ord.ConC-ID), /* additional Fields ({&T}-separated list */
    OUTPUT  l-Stat-Code,                /* status code. if ? then status invalid */
    OUTPUT  l-Return-Code               /* returncode passed by called procedure */
 ) NO-ERROR.
```

Pattern 1: Builder

This call with Builder (part of):

```
DEFINE VARIABLE oStatusCreate AS StatusCreate NO-UNDO.

oStatusCreate =
  (NEW StatusCreateBuilder()
  :setCustCode(l-DB-Cust)
  :setStatusNumeric(150)
...
  :setQtyType(OrderQtyQualifier)
  :setUTCTime(l-UTCTime)
  :setConCID(SSCO-Ord.ConC-ID)
...
  :build()).
```

Builder - Discussion

- Advantages
  - Improves readability
  - Named parameters
  - Auto-Complete supported
  - Allows late changes
- Practical use in 4 GL
  - Very good
- Disadvantages
  - 'None'
    (Multiple calls need time)
- Pattern or Anti-Pattern
  - What will make it an Anti-Pattern
    - Hidden validations
    - Nesting objects
    - Hierarchical structures
      (call is linear)
  - AVOID the above

Pattern 2: Singleton

- Type: Creational Pattern
- Kind of "global objects" in OO
- When to use
  - Need a global, single object all over the application
- Why to use:
  - Inheritance possible
  - Has some logic during instantiation
  - Saves resources
- Examples:
  - Configuration
  - Communication setup

Pattern 2: Singleton

Class with Singleton Pattern:

```
CLASS Konfiguration:
...
  DEFINE PUBLIC STATIC PROPERTY oInstance AS Configuration
    PUBLIC GET():
      IF oInstance = ? THEN
        oInstance = NEW Configuration().
      RETURN oInstance.
    END GET.
    PRIVATE SET.

  CONSTRUCTOR PRIVATE Configuration():
    loadConfig().
  END CONSTRUCTOR.
...
END CLASS.
```

Pattern 2: Singleton

Singleton call:

```
DEFINE VARIABLE oConf AS Configuration NO-UNDO.
DEFINE VARIABLE cMode AS CHARAKTER     NO-UNDO.

oConf = Configuration:oInstance.
oConf:LoadFromFile().

cMode = oKonf:getValue("RunMode").
```

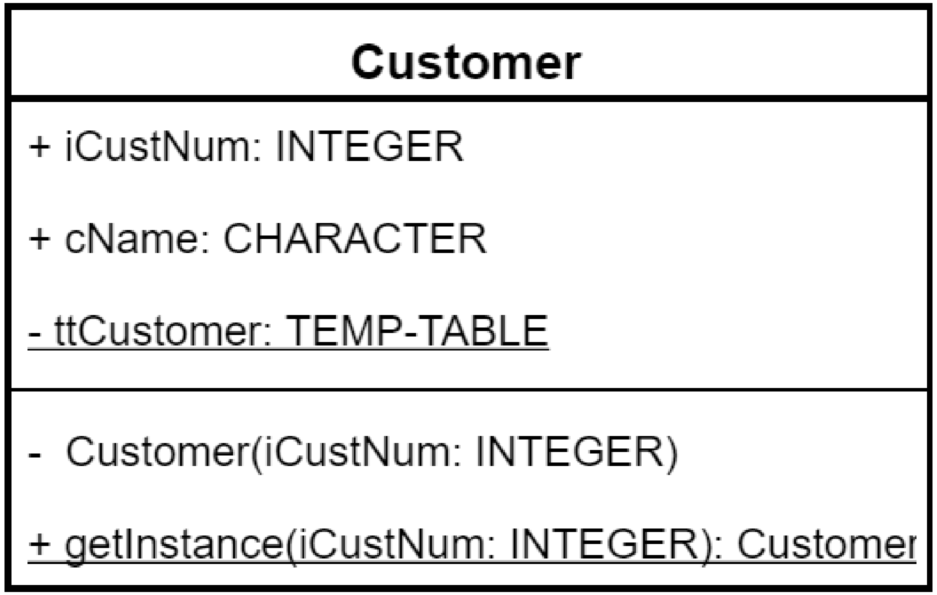
Singleton - Discussion

- Advantages
  - Solves problem of global settings
  - Inheritance is possible (which is not possible from a static object)
  - Has some logic during instantiation
  - Can be re-instantiated
    (not possible with a pure static object)
- Practical use in 4 GL
  - Good

- Disadvantages
  - 'None'
    (But seductive to misuse)
- Pattern or Anti-Pattern
  - What will make it an Anti-Pattern
    - Write in the object
    - Use as data structure
    - Use it for states
  - AVOID the above

Pattern 3: Multiton

- Type: Creational Pattern
- One static access method
- Objects saved with ID
- When to use:
  - N objects (data members) will be accessed randomly
- Why to use:
  - Performance
  - Save ressources
  - Simple code


Customer
+ iCustNum: INTEGER
+ cName: CHARACTER
- ttCustomer: TEMP-TABLE
- Customer(iCustNum: INTEGER)
+ getInstance(iCustNum: INTEGER): Customer

Pattern 3: Multiton

Sample part 1 (static Temp-Table):

```
...
  DEFINE PUBLIC PROPERTY iCustNum AS INTEGER NO-UNDO GET. PRIVATE SET.
  DEFINE PUBLIC PROPERTY cName AS CHARACTER NO-UNDO GET. PRIVATE SET.

  DEFINE PRIVATE STATIC TEMP-TABLE ttCustomer
    FIELD custNum AS INTEGER
    FIELD obj     AS Progress.Lang.Object
    INDEX ID custNum.
  .
...
END CLASS.
```

Pattern 3: Multiton

Sample part 2 (static access method):

```
CLASS Customer:
...
  METHOD PUBLIC STATIC Customer getInstance(iCustNum AS INTEGER):
    FIND FIRST ttCustomer WHERE ttCustomer.custNum = iCustNum NO-LOCK NO-ERROR.
    IF NOT AVAILABLE ttCustomer THEN DO:
      CREATE ttCustomer.
      ASSIGN
        ttCustomer.custNum   = iCustNum
        ttCustomer.obj     = NEW Customer(iCustNum)
      .
    END.

    RETURN CAST(ttCustomer.obj, Customer).
  END METHOD.
...
END CLASS.
```

Pattern 3: Multiton

Sample part 3 (private constructor):

```
CLASS Customer:
...
  CONSTRUCTOR PRIVATE Customer(iCustNum AS INTEGER):
    DEFINE BUFFER bCustomer FOR Customer.

    FIND FIRST bCustomer WHERE bCustomer.CustNum = iCustNum NO-LOCK NO-ERROR.
    IF AVAILABLE bCustomer THEN DO:
      THIS-OBJECT:cName    = bCustomer.Name.
      THIS-OBJECT:iCustNum = bCustomer.CustNum.
    END.
  END CONSTRUCTOR.
...
END CLASS.
```

Pattern 3: Multiton

Sample part 4 (usage):

```
DEFINE VARIABLE oMultiCust AS multiCust NO-UNDO.
...

oMultiCust = 03_multiton.multiCust:getInstance(1537).
cName1 = oMultiCust:cCustName.
oMultiCust = 03_multiton.MultiCust:getInstance(1).
cName2 = oMultiCust:cCustName.
```

Multiton - Discussion

- Advantages
  - Simple code
  - Requests get same data (DB, WebServices, ESB...)
- Practical use in 4 GL
  - Poor (Performance)
- Disadvantages
  - Object accumulate ('global')
  - Slow in OO ABL
- Pattern or Anti-Pattern
  - What will make it an Anti-Pattern
    - Write in the objects
    - Use it for states
  - AVOID the above

Pattern 4: Lazy Loading

- Type: Creational Pattern
- Delay until access:
  - Object creation
  - Calculations, summaries...
  - Other expensive processing
- When to use:
  - Initialising of a resource (class, tab, communication...) takes long
- Why to use:
  - Fast start
  - Save effort for things not used in current session

Pattern 4: Lazy Loading

Sample part 1 (constructor & other properties):

```
CLASS Invoice:
...
  CONSTRUCTOR PUBLIC Invoice(iInvoiceNum AS INTEGER):
    DEFINE BUFFER bInvoice FOR Invoice.

    FIND FIRST bInvoice WHERE bInvoice.Invoicenum = iInvoiceNum NO-LOCK NO-ERROR.
    IF AVAILABLE bInvoice THEN DO:
      THIS-OBJECT:iInvoiceNum = iInvoiceNum.
      THIS-OBJECT:iCustNum    = bInvoice.CustNum.
    END.
  END CONSTRUCTOR.
...
END CLASS.
```

Pattern 4: Lazy Loading

Sample part 2 (property):

```
DEFINE PUBLIC PROPERTY iInvoiceSum AS INTEGER NO-UNDO INITIAL ?
  PUBLIC GET:
    IF iInvoiceSum = ? THEN DO:
      DEFINE VARIABLE iCN AS INTEGER NO-UNDO.
      iCN = THIS-OBJECT:iCustNum.
      //loop through invoices of customer
      // FOR EACH invoices... WHERE invoices.CustNum = iCustNum...
      //accumulate invoices
    END.
    RETURN iInvoiceSum.
  END GET.
  PRIVATE SET.
```

Lazy Loading - Discussion

- Advantages / Use cases
  - Access aggregated data
  - Infinite scroll
    (images, browser)
  - Tab widget is selected
  - Initialize a service for first use
    (ESB, log system, rpc…)

- Practical use in 4 GL
  - Very good

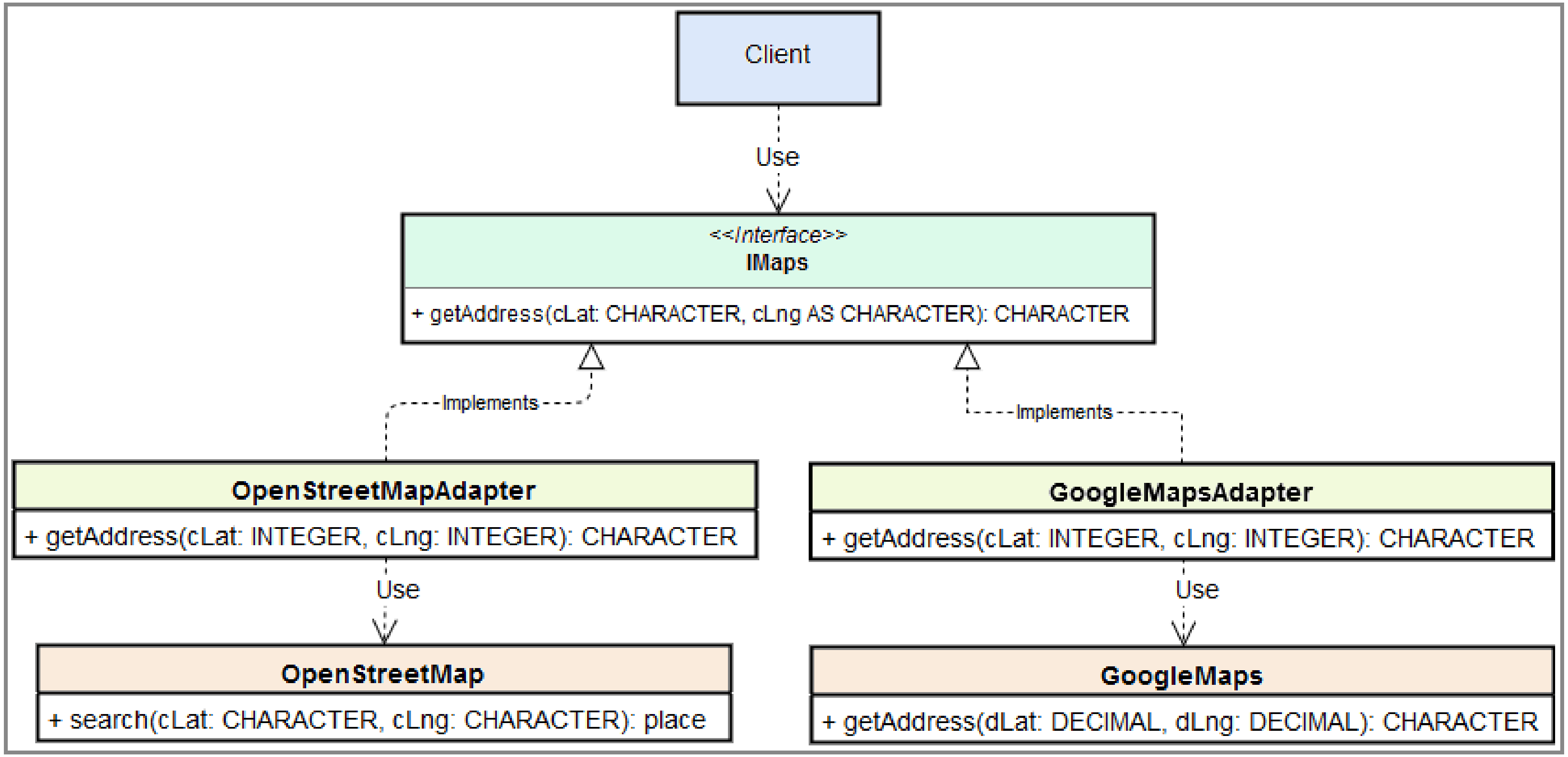
- Disadvantages
  - Extracting (dislocating) code
  - May increase overall calls to DB
  - May show inconsistent data
  - Delay may show up later

- Pattern or Anti-Pattern
  - What will make it an Anti-Pattern
    - Write in the objects
    - Use it for states
  - AVOID the above

Pattern 5: Adapter

- Type: Struktural Pattern
- Combine two incompatible interfaces
- When to us:
  - Make systems more flexible
  - Wrap 3rd party / old code
- Why to use:
  - Have only one (simpler) interface
  - Integrate other libraries / 3rd party

Pattern 5: Adapter


Client
Use
<<Interface>>
IMaps
+ getAddress(cLat: CHARACTER, cLng AS CHARACTER): CHARACTER
Implements
Implements
OpenStreetMapAdapter
+ getAddress(cLat: INTEGER, cLng: INTEGER): CHARACTER
GoogleMapsAdapter
+ getAddress(cLat: INTEGER, cLng: INTEGER): CHARACTER
Use
Use
OpenStreetMap
+ search(cLat: CHARACTER, cLng: CHARACTER): place
GoogleMaps
+ getAddress(dLat: DECIMAL, dLng: DECIMAL): CHARACTER

Pattern 5: Adapter

```
CLASS OpenStreetMapAdapter IMPLEMENTS IMaps:
  DEFINE PRIVATE PROPERTY oOpenStreetMap AS OpenStreetMap NO-UNDO
    PRIVATE GET.
    PRIVATE SET.

  CONSTRUCTOR PUBLIC OpenStreetMapAdapter():
    oOpenStreetMap = NEW OpenStreetMap().
  END CONSTRUCTOR.



  METHOD PUBLIC CHARACTER getAddress(cLat AS CHARACTER ,cLng AS
CHARACTER):
     RETURN oOpenStreetMap:search(cLat, cLng):Address.
  END METHOD.
END CLASS.
```

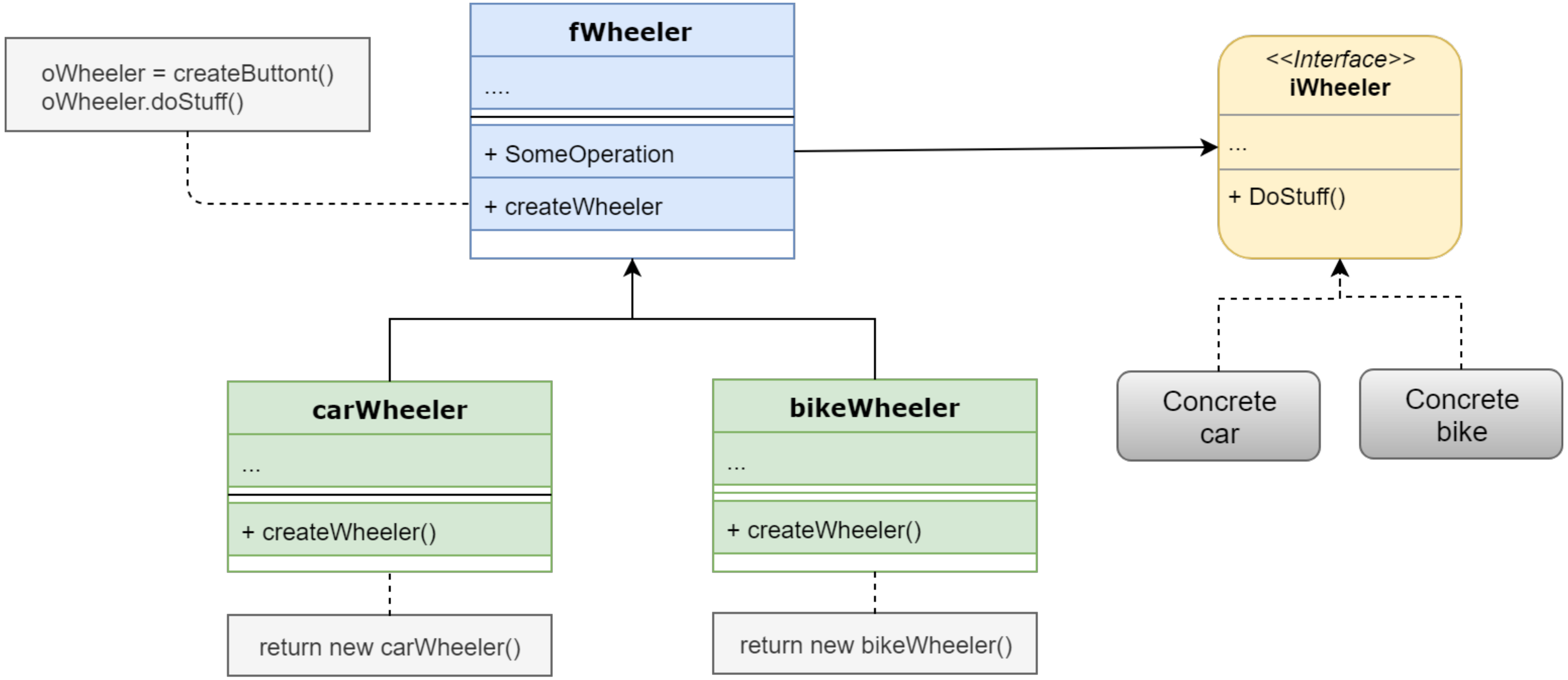
Adapter - Discussion

- Advantages
  - Allow subsystem changes
  - Reuse objects
  - Adapt 3rd party objects
  - Simplify
    (e.g. remove complex API)
- Practical use in 4 GL
  - Very good
- Disadvantages
  - More code
  - Small run-time overhead
- Pattern or Anti-Pattern
  - It is a pattern

Pattern 6: Factory Factory

- Type: Creational Pattern
- Use an abstract method for object creation
- When to use:
  - Make code more flexible
  - During compile the final class is unknown
- Why to use:
  - Have generic Interface
  - Loose coupling
  - Extensible structure
- Use samples:
  - Create UI elements (classic OE UI, .NET UI)
  - Unit testing

Pattern 6: Factory



Pattern 6: Factory

Show Demo Code

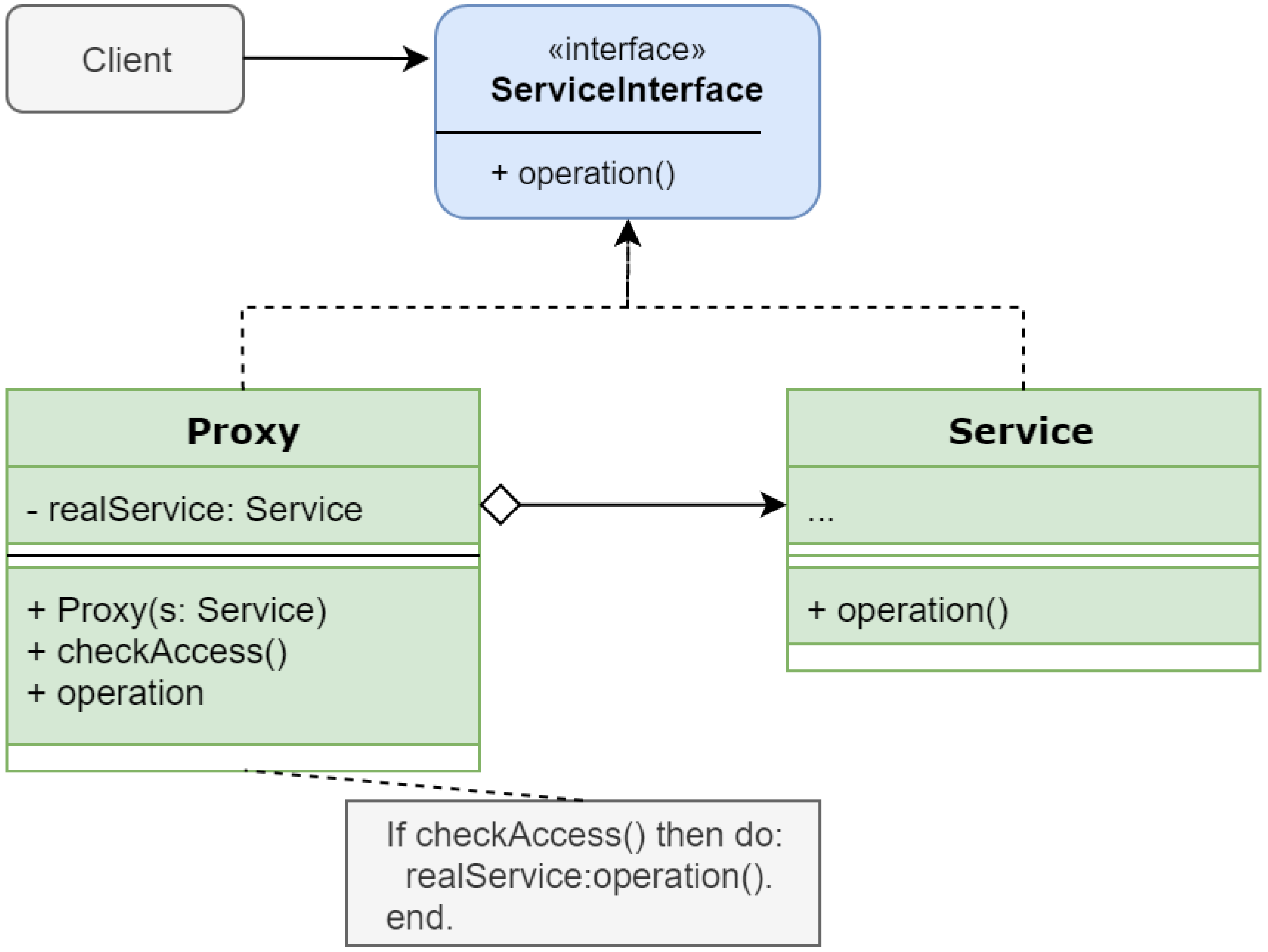
Pattern - Discussion

- Advantages
  - Loose coupling (creator / created)
  - Same creation code for every case
  - Extensible
  - Testing (mock) is simple
  - Increase abstraction level (reduce maintenance)
- Practical use in 4 GL
  - Very good
- Disadvantages
  - Add complexity and some code
- Pattern or Anti-Pattern
  - It is a pattern

Pattern 7: Proxy

- Type: Behavioural Pattern
- Why to use:
  - Use remote objects like local objects
  - Protect an object (security)
  - Reduce visible object complexity
- Why to use:
  - More independence (interfaces)
  - Create distributed systems
  - Simpler programming
- Examples:
  - Authentication
  - Remote method invocation

Pattern 7: Proxy



Pattern 7: Proxy

Show Demo Code

Conclusion

- Seven of 23 pattern discussed:
  - Builder, Singleton, Multiton, Lazy Loading, Adapter, Factory, Proxy
- A company should defines pattern policies
- When there is a useful pattern, use it
  - It helps to organize a project
  - It helps to talk about code

Questions?

Full article (online / PDF)
and sample sources
available on Monday:

https://www.iap.de/blog
https://www.iap.de/downloads

Klaus Erichsen