Configuring in the Browser, Really!

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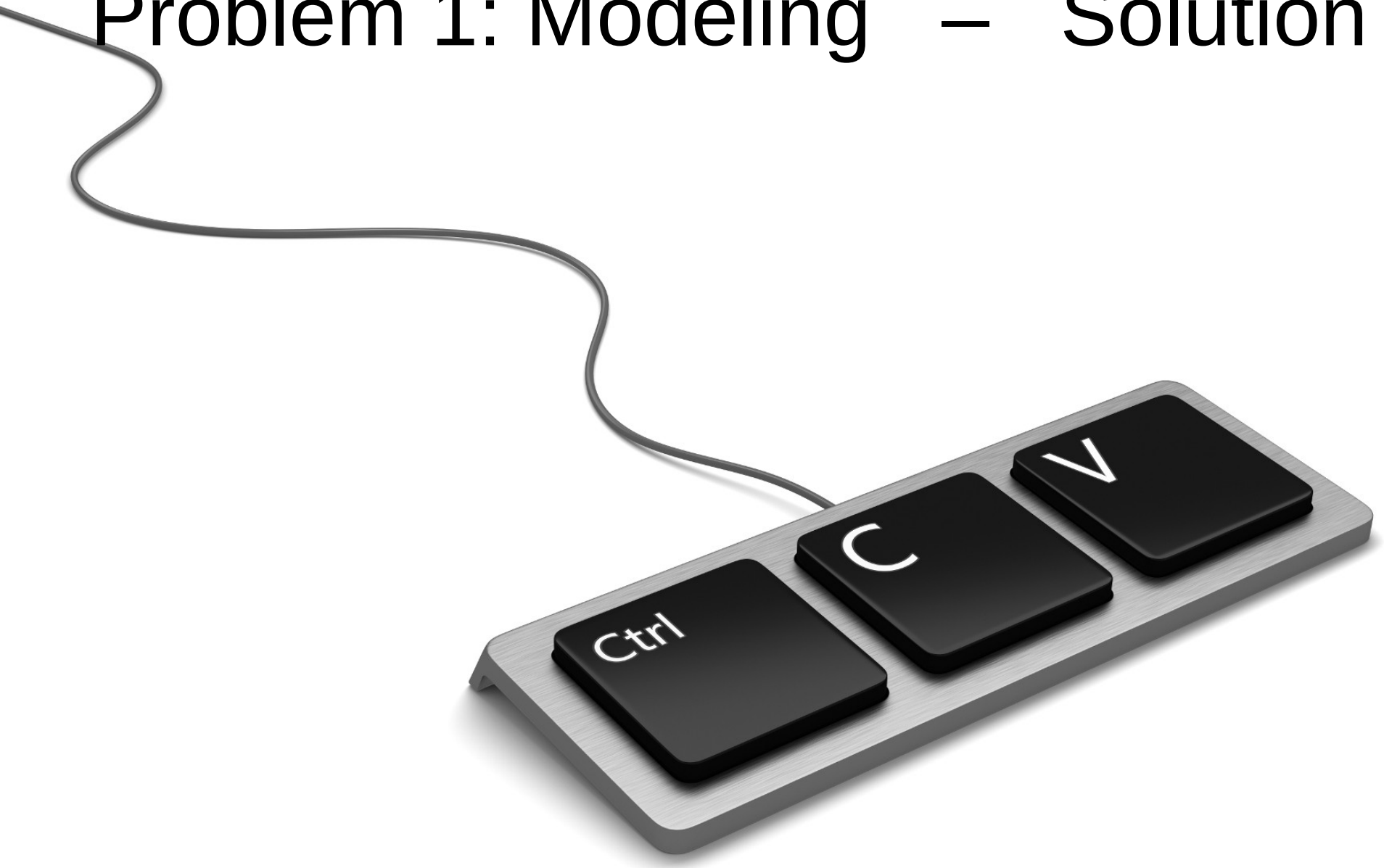
Our History

- Product configuration since 2002, with SAP since 2007
- Built and maintained
  - Models
  - Modeling environments
  - Configuration frameworks

Problem 1: Modeling

- Framework-specific modeling tools
- Lack of abstraction features and data structures
  - Loops, functions
  - Arrays, objects (with methods)
- Models not represented as human-readable text
  - Edit, search & replace
  - Discuss, annotate
  - Compare, manage revisions

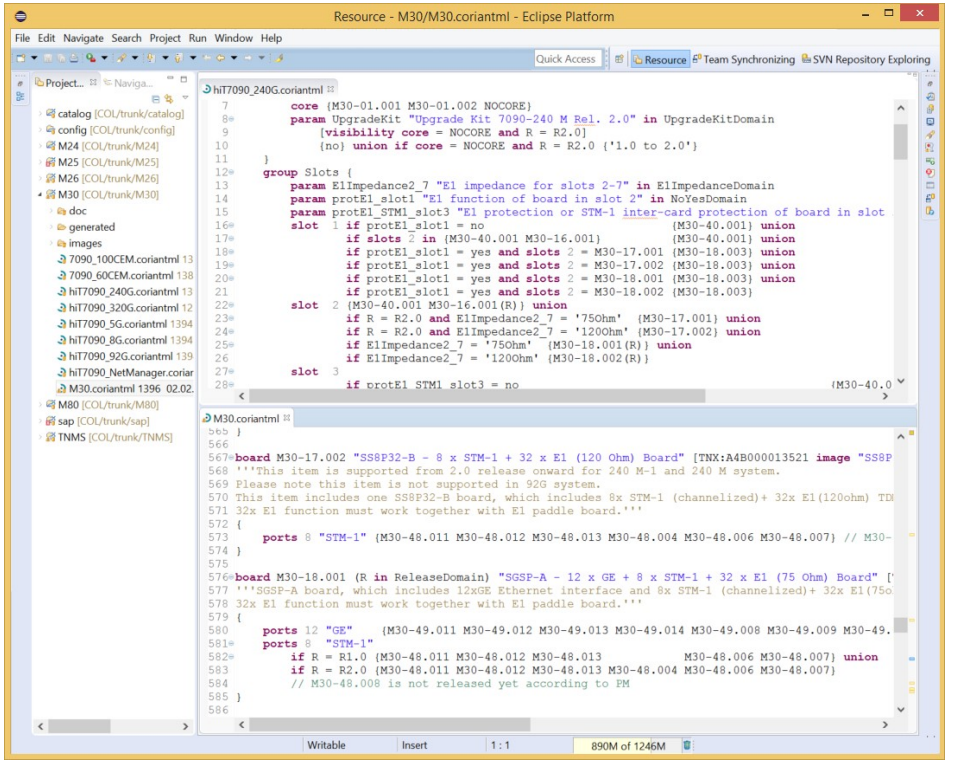
Problem 1: Modeling – Solution A



Problem 1: Modeling – Solution B

Our solution so far:

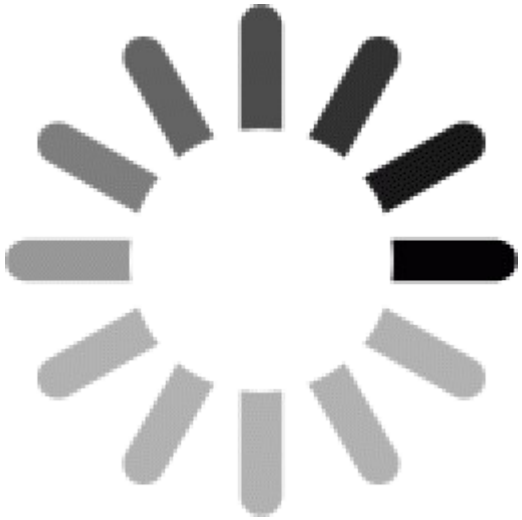
- Customer-specific modeling languages
- Modeling environments based on Eclipse and Xtext
- Automated generation of model representation for target framework
- See also CWG talks
  - Vienna 2010:
    ConfigModeler and VClipse - languages and IDEs for product modeling
  - Cologne 2011:
    Domain-Specific Languages for Product Modeling
  - Berlin 2012:
    How to Build Your Own Product-Modeling Environment?



Problem 1: Modeling – Solution C

- Use a programming language
  - For application-specific inferencing
  - But also to build up the model
- Use programming tools
  - Editors/IDEs
  - Debuggers and profilers
  - Revision control
  - Test and CI frameworks
- General purpose tools and languages
  - Maturity
  - Re-usable knowledge, may already be available
  - Large communities and „ecosystems“

Problem 2: User Experience



Problem 2: User Experience

- Performance
  - Client-server round trips
- Rigid UI
  - UI structure imposed by framework
  - High costs for application-specific UI
- Need to be online

Increasing gap:

Configurators ↔ Modern web applications

In the meantime ...

In the meantime ...

Client hardware improved

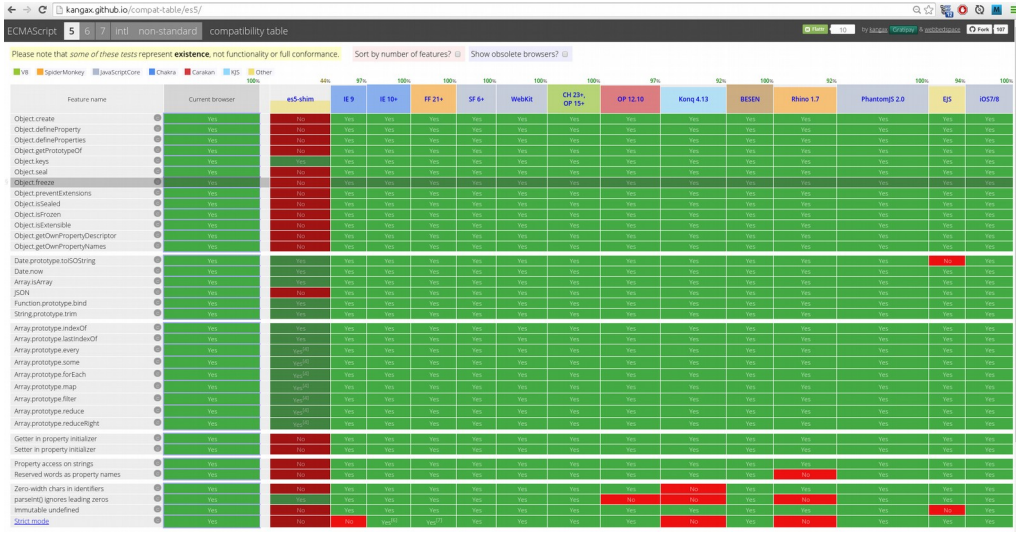
- CPU
- Memory
- Even on mobiles

… but the speed of light remained the same.

In the meantime ...

Browser improvements:

- JavaScript performance
- Standardized features
  - UI extensions
  - Offline applications
  - Local storage
  - ...
- Improved compatibility



http://kangax.github.io/compat-table/es5/

In the meantime ...

A software ecosystem for web applications flourished:

- Web-application frameworks
- Preprocessors for JavaScript/HTML/CSS
- Libraries
- Build tools
- ...

In the meantime ...

Web browsers have become a serious application platform.

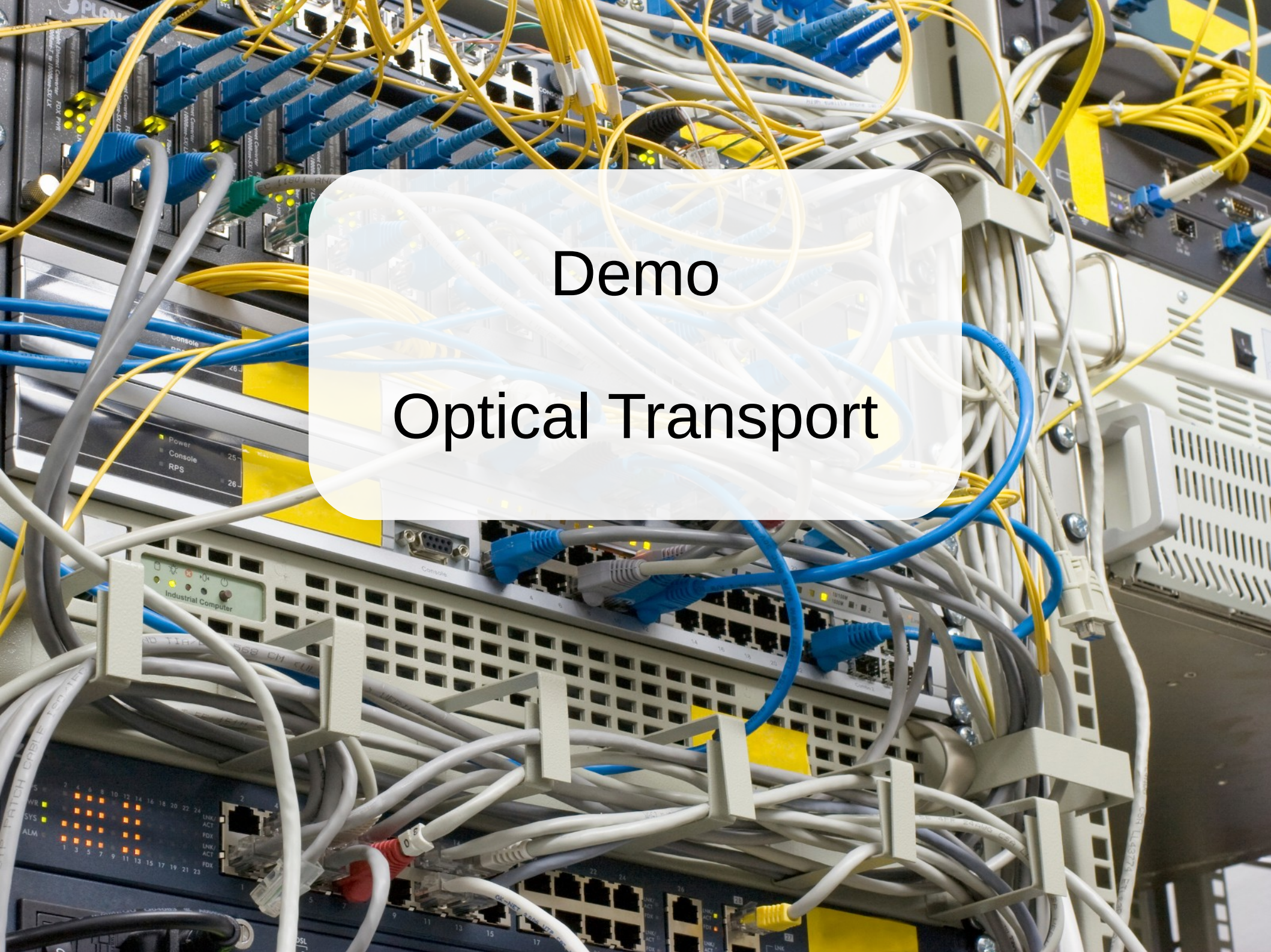
Even for the business logic.

And they are getting better and better.

Configuring in the Browser:

Implement configurators in JavaScript.

JavaScript is also
a reasonable choice for modeling.

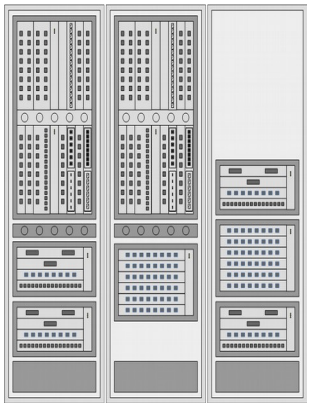


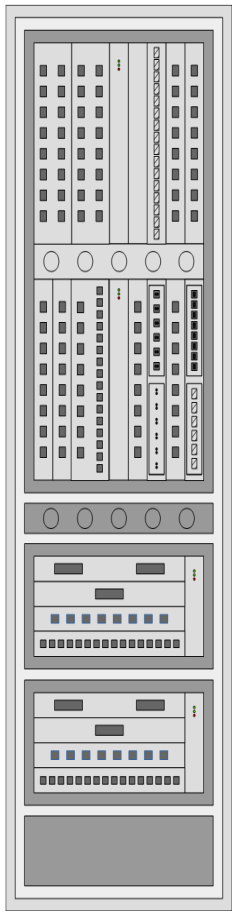
Demo

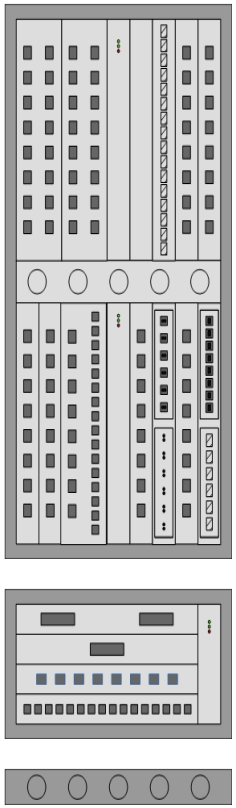
Optical Transport

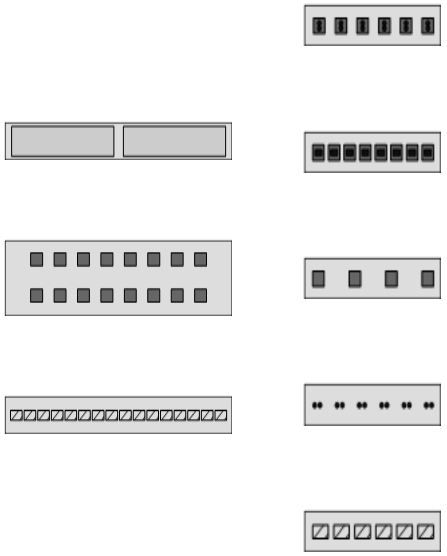
Demo Example: Hierarchical Configuration

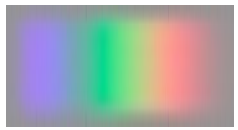
Solution Rack Switch Board (Module) Transceiver (Wavelength)











Demo

http://opencpq.webxcerpt.com/examples/optical-transport/

opencpq.webxcerpt.com/examples/optical-transport/

undo | redo | reset | save | restore | Datei auswählen | Keine ausgewählt | import | export

Configuration

Solution

Project Settings

Release

Rel. 1.0

Rack Type

ANSI

Uninterruptible Power Supply (default for each rack)

Racks

#	Rack
1	Uninterruptible Power Supply Switches

#	Product
2	Optical Switch OS6 Slot 1 16 x 10 G board

Contents

- Project Settings
- #1: Rack
  - #1: 2 × OS6
  - #2: OS6
- #2: Rack
  - #1: OS4
- Network Management
- Services

Bill of Materials

export as CSV

#	Material No.	Description	Price (€)
3	SFP+:SR	SFP+ SR (850 nm, up to 300 m)	1.000,00
3	B:16x10	16 x 10 G board	25.000,00
16	B:FP	Blank faceplate for board slots	20,00

open – a JavaScript-based Configurator Framework

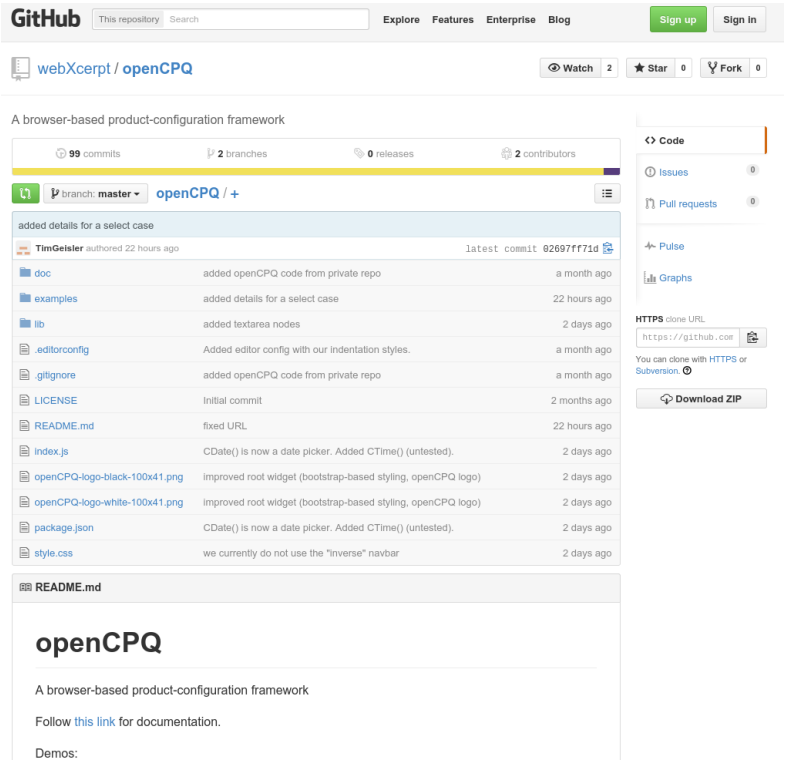
- Building-block library
  - Components
  - Dependencies
- Combine building blocks with JavaScript
- Add application-specific building blocks
- A light-weight layer based on ReactJS and Bootstrap

– an Open-Source Project

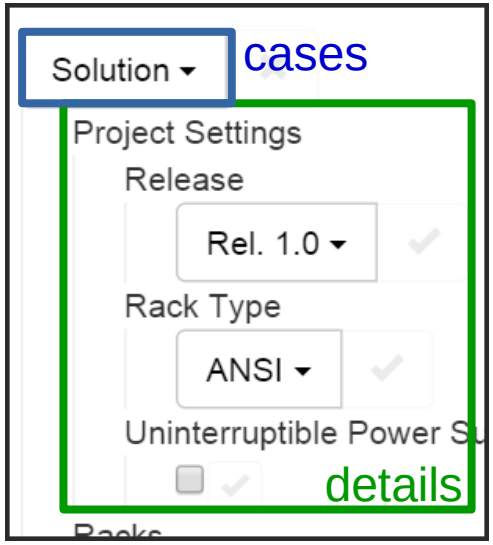
Source code and links to live demos available on Github:
https://github.com/webXcerpt/openCPQ

Liberal MIT license

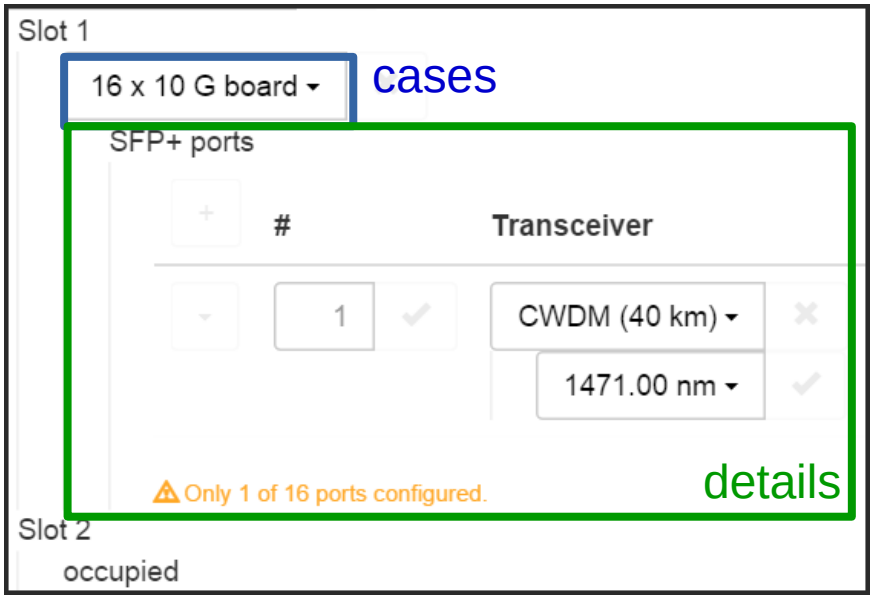
Use, adapt,
integrate, contribute!



Modeling with openCPQ: Cases with Details




```
var configuration = CSelect([
    unansweredCase("Select Configuration Mode"),
    ccase("Switches", "Optical Switches",
        CQuantifiedList({}, "Optical Switch",
                        opticalSwitches)),
    ccase("Rack",     "Racks",
        CQuantifiedList({}, "Rack",
                        rack)),
    ccase("Solution", "Solution",
          solution),
]);
```




```
function boards(isDoubleWidthSlot) {
    return CSelect([
        for (b of components.boards)
            if (!b.doubleWidth ||
                isDoubleWidthSlot)
                ccaseBOM(b.name, b.label,
                    ports(b.ports))
    ]);
}
```

Data-Driven Modeling with openCPQ

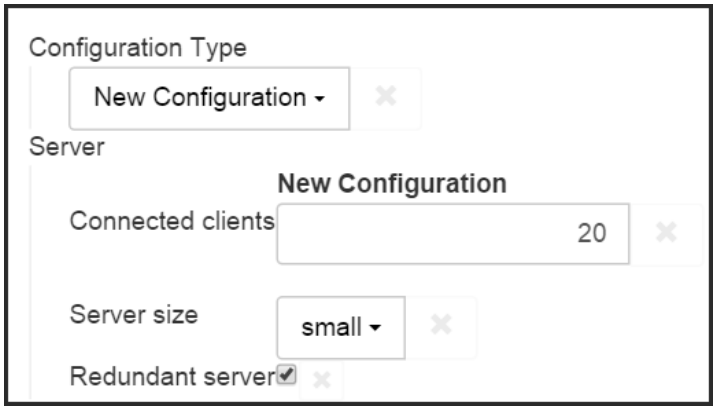
Boards

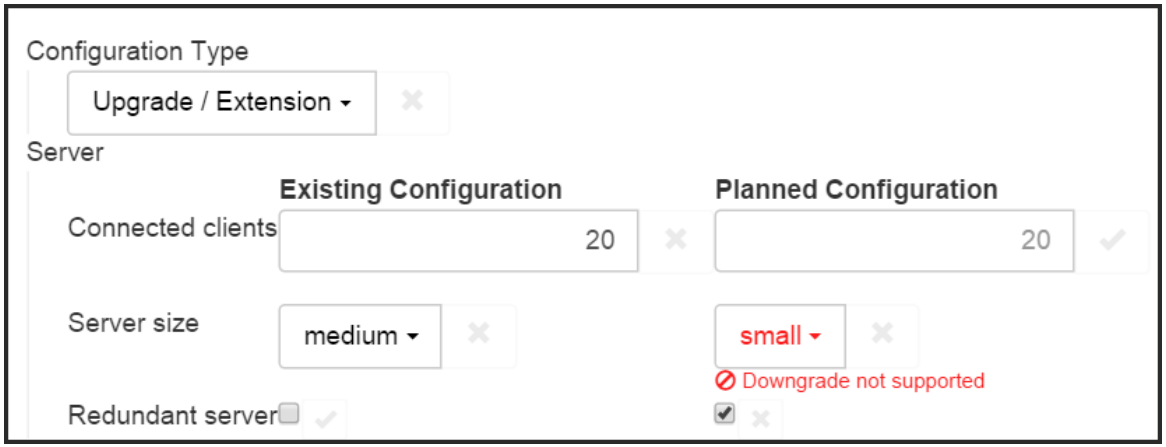
Name	Label	Double width	Power	Ports		
				Label	Count	Type
B:FP	unequipped					
B:8x10_16x1	8 x 10 G + 16 x 1 G board	y	45	SFP+ ports	8	SFP+
				SFP ports	16	SFP
B:8x10	8 x 10 G board		30	SFP+ ports		
B:16x10	16 x 10 G board	y	50	SFP+ ports		
B:16xE1_75	16 x E1 electrical board (75 Ohm)		40			
B:16xE1_120	16 x E1 electrical board (120 Ohm)		40			
B:2x40	2 x 40 G board		60	QSFP+ ports		
B:1x100	1 x 100 G board		60	CFP ports		


```
function boards(isDoubleWidthSlot) {
    return CSelect([
        for (b of components.boards)
            if (!b.doubleWidth || isDoubleWidthSlot)
                ccaseBOM(b.name, b.label,
                    aggregate("power", b.power,
                        ports(b.ports)))
    ]);
}
```

Concise specification of complex models

Modeling with openCPQ: Application-specific Abstractions

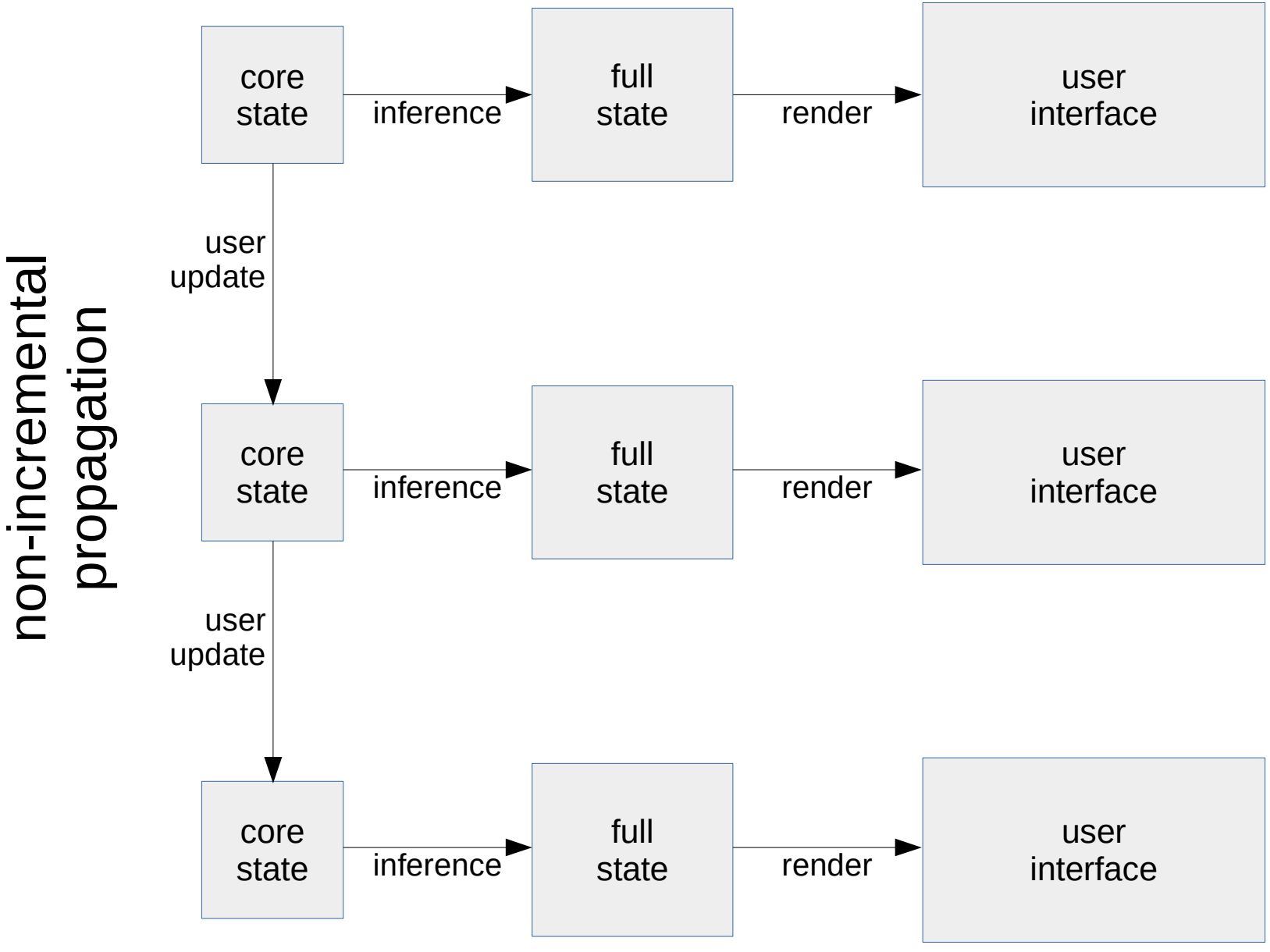




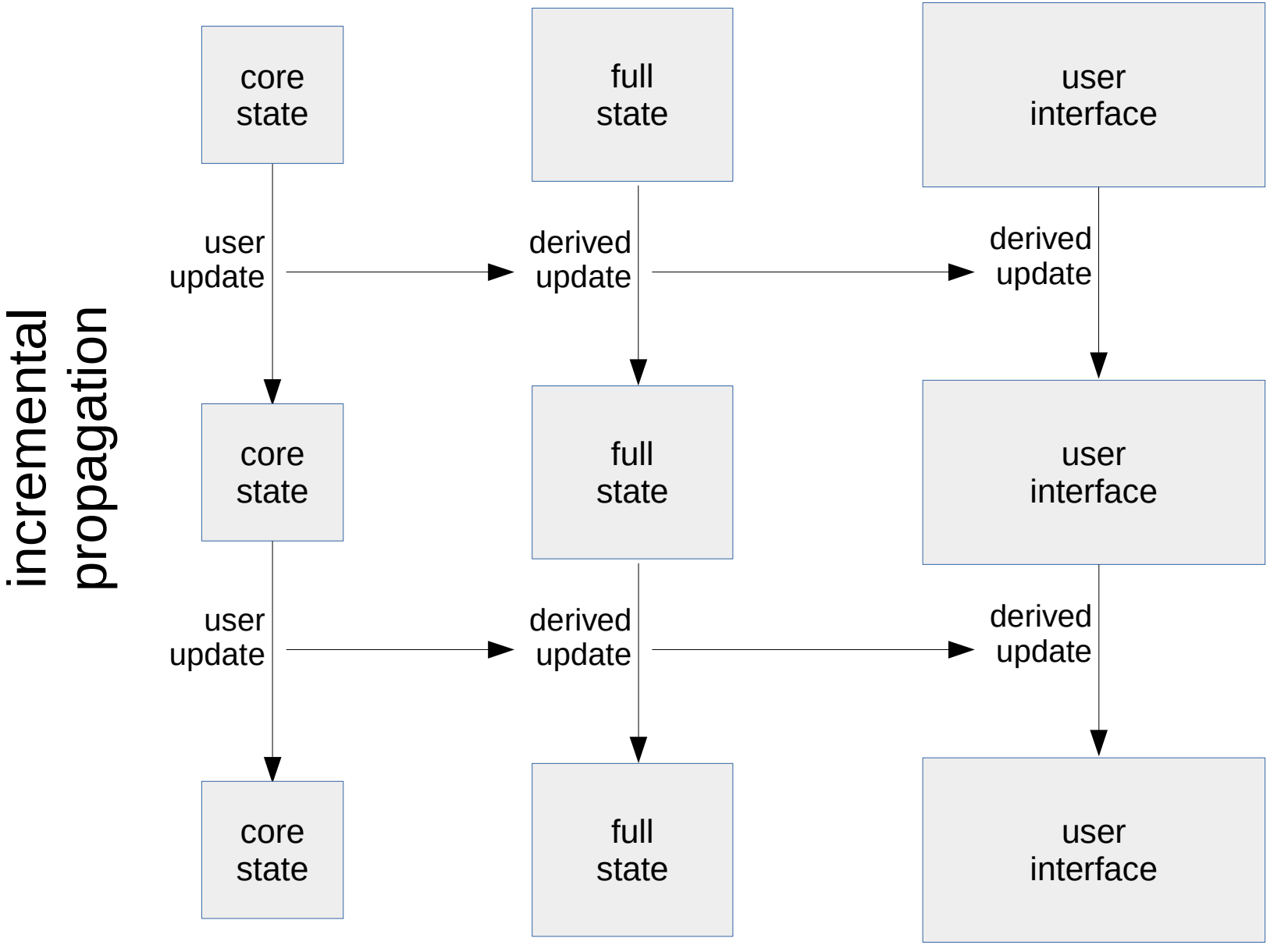

```
CNameSpace("props", CGroup([
    cmember("ConfigType", "Configuration Type",
        CNamed("props", "ConfigType", {valueAccessor: n => n.value}, CSelect([
            ccase("NEW", "New Configuration"), ccase("EXT", "Upgrade / Extension"),
    ])),
    cmember("Server", "Server", ep.table([
        ep.rowInteger("clients", "Connected clients"),
        crow("Size", "Server size", ({props}) => props.ConfigType === "EXT"
            ? [ep.eCell("Size", CSelect([for (s of serverSizes) ccase(s)])),
               () => ep.pCell("Size", CSelect([for (s of serverSizes)
                   onlyIf(serverSizes.indexOf(s) >= serverSizes.indexOf(ep.E(props.Size)),
                          "Downgrade not supported", [ccase(s)])]))]
            : [ep.pCell("Size", CSelect([for (s of serverSizes) ccase(s)]))]
        ),
        ep.rowBoolean("redundancy", "Redundant server"),
    ])),
])),
```

How it Works

Change Propagation



Change Propagation

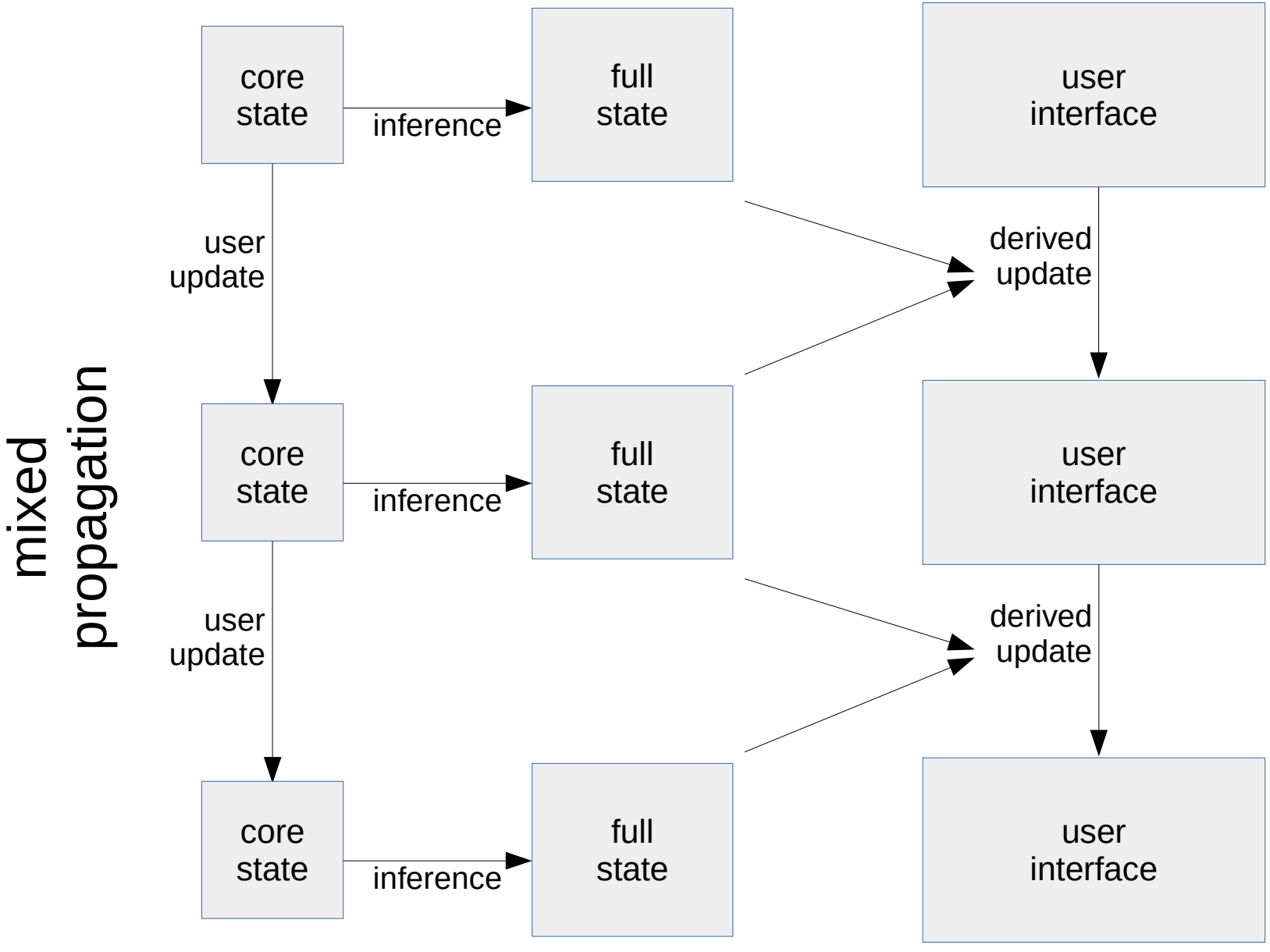


Change Propagation

Trade-off:

- Non-incremental propagation:
  - Redo inference steps
    - CPU consumption
  - Redo rendering
    - CPU consumption
    - Flicker, loss of UI state (focus, scroll, selection), ...
- Incremental propagation:
  - Keep track of dependencies
    - Error-prone (unless completely shielded from the modeler)
    - Consumes memory and CPU

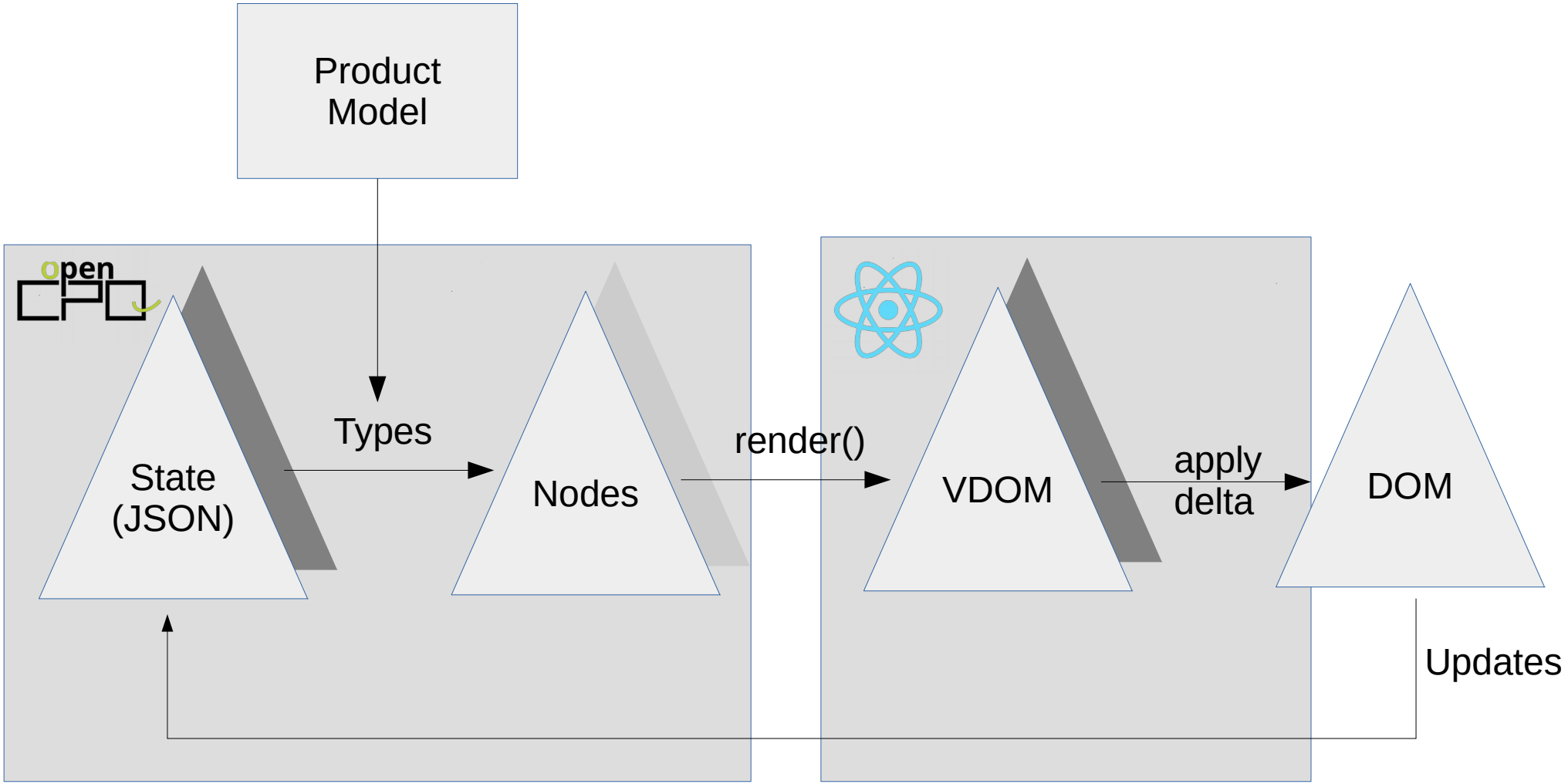
Change Propagation



React:
A JavaScript library for building user interfaces

- Unique approach:
  - not a widget library
  - not an MVC framework
- Virtual DOM ("VDOM"):
  - Representation of the DOM tree as a JavaScript data structure (cheap!)
- Upon each update:
  - User code
    - generates VDOM from your model
    - possibly using XML templating integrated into JavaScript ("JSX")
  - React
    - diffs the VDOM with the previous VDOM
    - applies only the diff to the actual DOM

Architecture



SAP Integration

- Models
  - Conversion of LO-VC and IPC models to openCPQ
    - Schema, basic logic: automatable with VClipse extension
    - Complex logic: manual conversion
  - Model storage and management
    - Just static resources
    - App server not needed (but can be used)

SAP Integration

- Data
  (e.g. materials with classification information)
  - Live vs. pre-exported
  - Bundling with application vs. loading on demand
- Runtime
  - Loading and saving configurations
    - External configurator API
    - Mimic IPC

Summary

Take advantage of modern **browser technology** for product configuration.

Powerful **modeling** based on JavaScript, React, and openCPQ.

Flexible and fast **user interface**.

Use, adapt, integrate, contribute!
https://github.com/webXcerpt/openCPQ

Our Offer

Discuss:

- Use cases, modeling challenges, …
- Integrations

Cooperate:

- Professional services, training, ...
- For end users or integrators

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