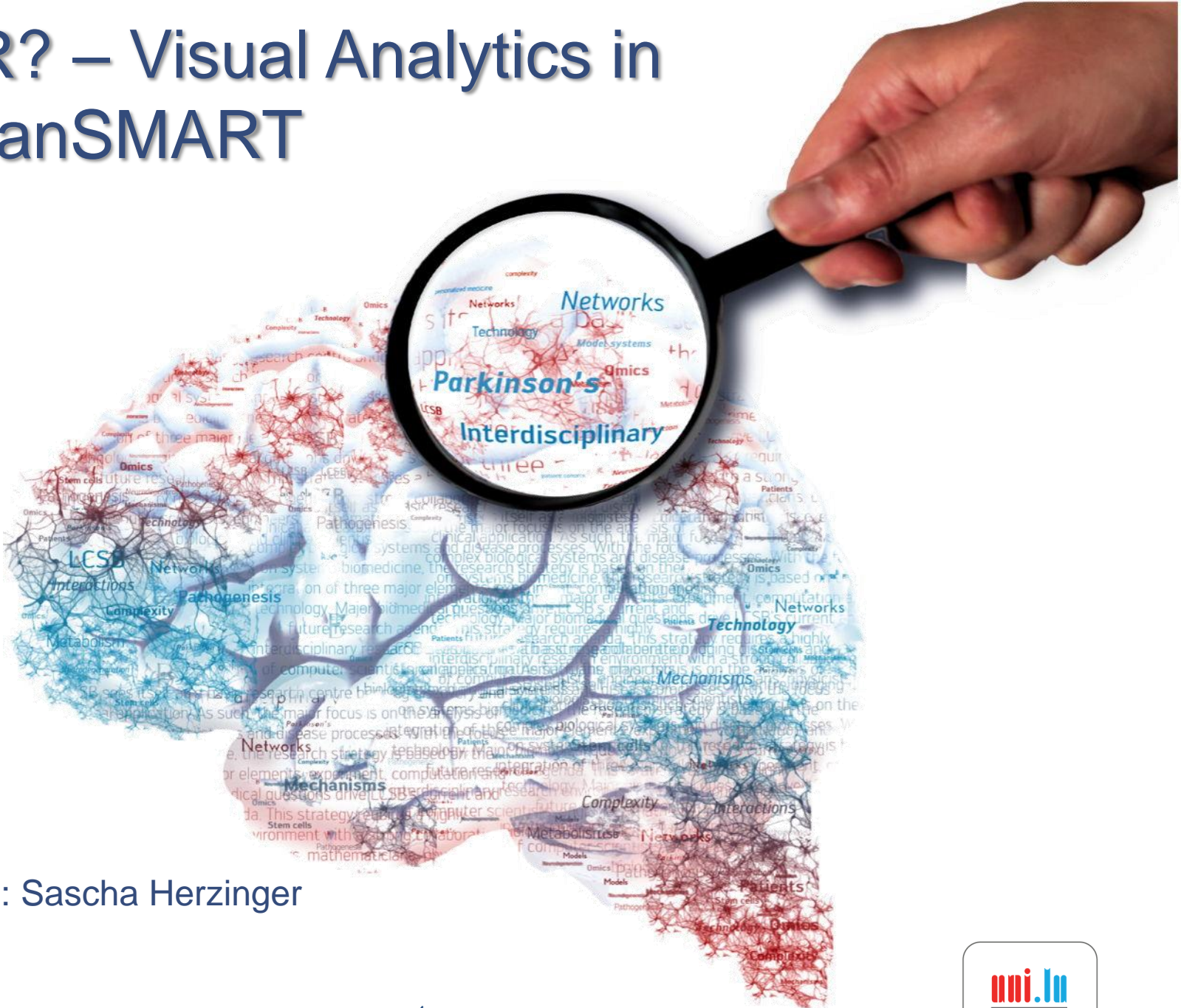


SmartR? – Visual Analytics in i2b2/TranSMART



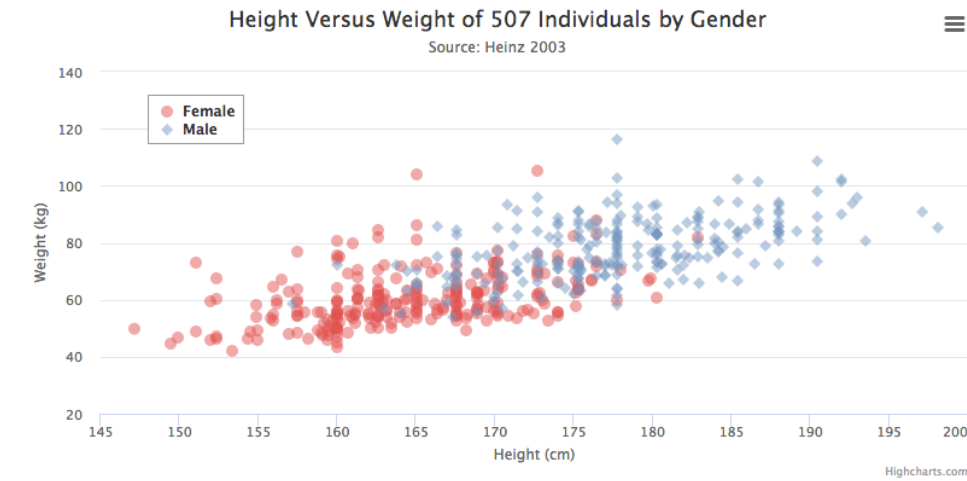
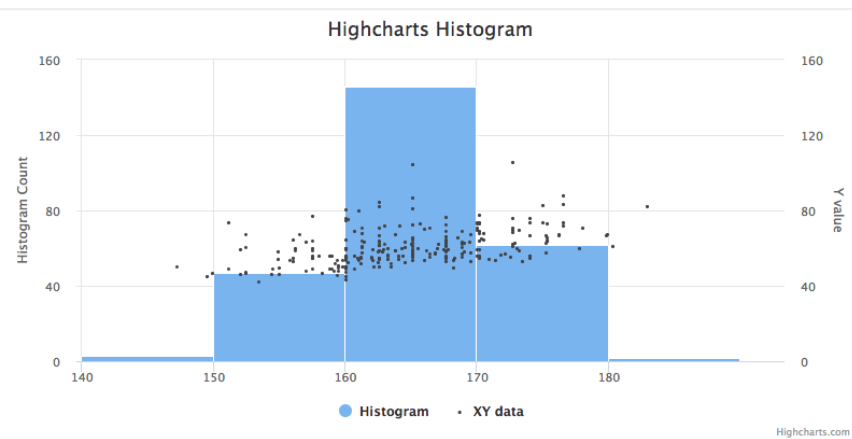
Presentation: Sascha Herzinger

Goal

- Bring visual analytics to translational research platforms
- Permit explorative analysis that complements hypothesis driven research
- Explorative analysis is about finding the question first, because providing answers is expensive

What are "visual analytics"?

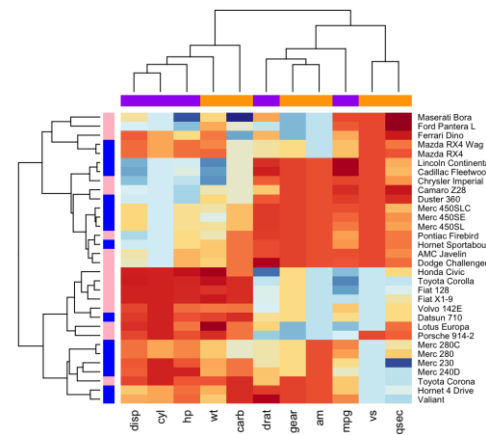
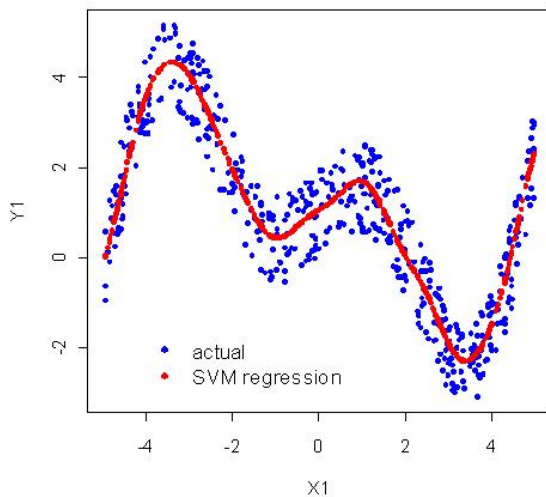
- The name suggests a visual and an analytical component
- Is this visual analytics?



- No. There is a visual component, but the analytical component is negligible.

What are "visual analytics"?

- How about R?
- Are these visual analytics?

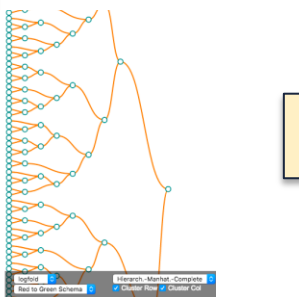
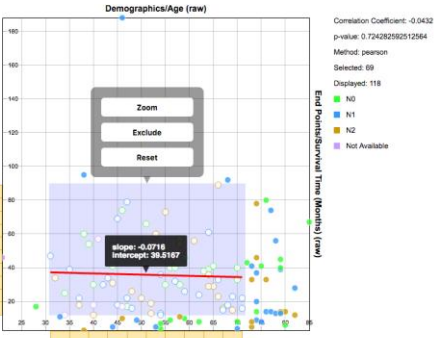
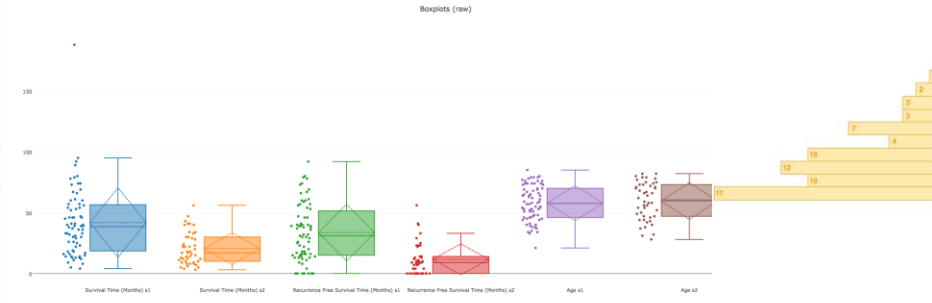
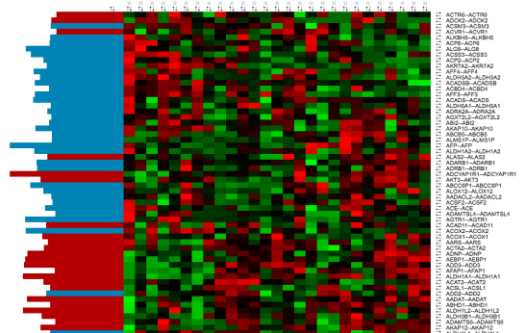
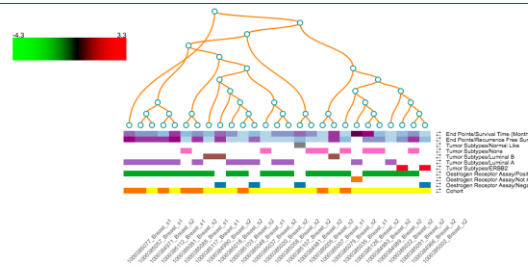


- Absolutely! There is a visual component and an analytical component (SVM regression / clustering)

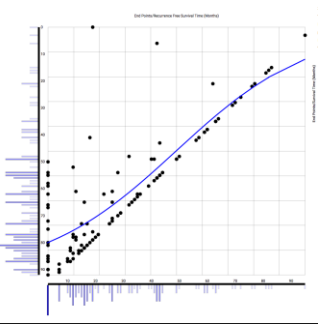
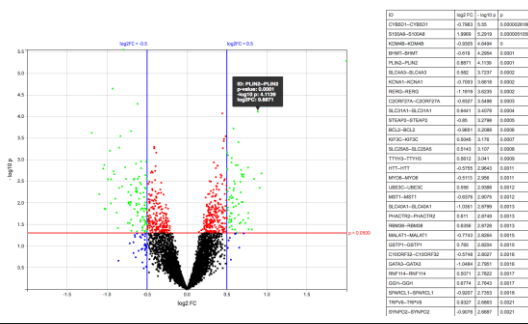
Ok, so why not just using R?

- Strong analytical component, but the visual capabilities are rather lacking.
- Possible Solution: Using R for analytics and the web browser for the visualisation.
- *SmartR* does just that!

What is SmartR?

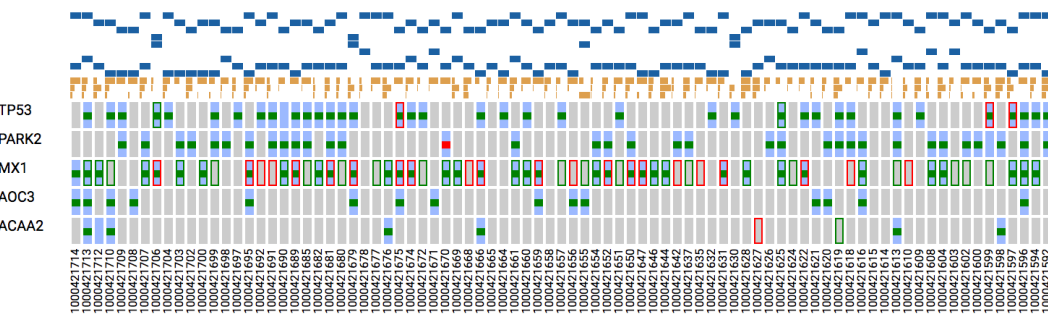
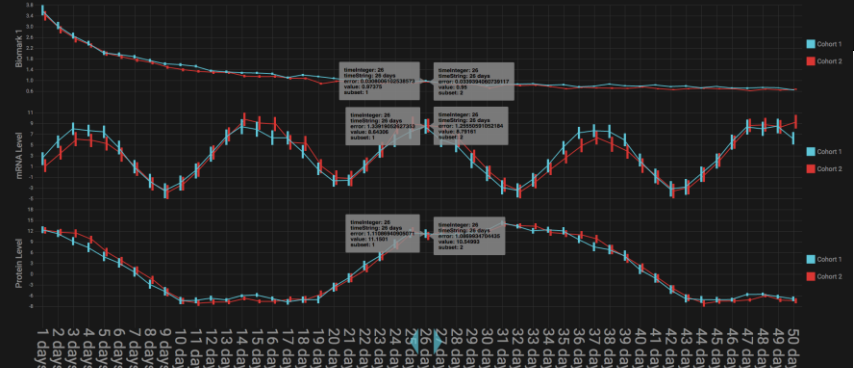
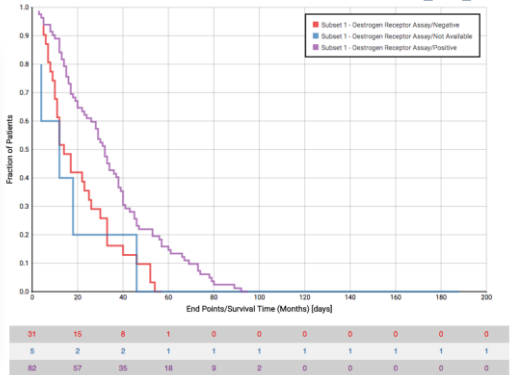


This.



[1]

ID	Gene Set Name	Score
1	ALB1, ALB1B, ALB1C, ALB1D, ALB1E, ALB1F, ALB1G, ALB1H, ALB1I, ALB1J, ALB1K, ALB1L, ALB1M, ALB1N, ALB1O, ALB1P, ALB1Q, ALB1R, ALB1S, ALB1T, ALB1U, ALB1V, ALB1W, ALB1X, ALB1Y, ALB1Z, ALB2, ALB3, ALB4, ALB5, ALB6, ALB7, ALB8, ALB9, ALB10, ALB11, ALB12, ALB13, ALB14, ALB15, ALB16, ALB17, ALB18, ALB19, ALB20, ALB21, ALB22, ALB23, ALB24, ALB25, ALB26, ALB27, ALB28, ALB29, ALB30, ALB31, ALB32, ALB33, ALB34, ALB35, ALB36, ALB37, ALB38, ALB39, ALB40, ALB41, ALB42, ALB43, ALB44, ALB45, ALB46, ALB47, ALB48, ALB49, ALB50, ALB51, ALB52, ALB53, ALB54, ALB55, ALB56, ALB57, ALB58, ALB59, ALB60, ALB61, ALB62, ALB63, ALB64, ALB65, ALB66, ALB67, ALB68, ALB69, ALB70, ALB71, ALB72, ALB73, ALB74, ALB75, ALB76, ALB77, ALB78, ALB79, ALB80, ALB81, ALB82, ALB83, ALB84, ALB85, ALB86, ALB87, ALB88, ALB89, ALB90, ALB91, ALB92, ALB93, ALB94, ALB95, ALB96, ALB97, ALB98, ALB99, ALB100	32
2	ATAD1, ATAD2, ATAD3, ATAD4, ATAD5, ATAD6, ATAD7, ATAD8, ATAD9, ATAD10, ATAD11, ATAD12, ATAD13, ATAD14, ATAD15, ATAD16, ATAD17, ATAD18, ATAD19, ATAD20, ATAD21, ATAD22, ATAD23, ATAD24, ATAD25, ATAD26, ATAD27, ATAD28, ATAD29, ATAD30, ATAD31, ATAD32, ATAD33, ATAD34, ATAD35, ATAD36, ATAD37, ATAD38, ATAD39, ATAD40, ATAD41, ATAD42, ATAD43, ATAD44, ATAD45, ATAD46, ATAD47, ATAD48, ATAD49, ATAD50, ATAD51, ATAD52, ATAD53, ATAD54, ATAD55, ATAD56, ATAD57, ATAD58, ATAD59, ATAD60, ATAD61, ATAD62, ATAD63, ATAD64, ATAD65, ATAD66, ATAD67, ATAD68, ATAD69, ATAD70, ATAD71, ATAD72, ATAD73, ATAD74, ATAD75, ATAD76, ATAD77, ATAD78, ATAD79, ATAD80, ATAD81, ATAD82, ATAD83, ATAD84, ATAD85, ATAD86, ATAD87, ATAD88, ATAD89, ATAD90, ATAD91, ATAD92, ATAD93, ATAD94, ATAD95, ATAD96, ATAD97, ATAD98, ATAD99, ATAD100	30
3	ABHD1, ABHD2, ABHD3, ABHD4, ABHD5, ABHD6, ABHD7, ABHD8, ABHD9, ABHD10, ABHD11, ABHD12, ABHD13, ABHD14, ABHD15, ABHD16, ABHD17, ABHD18, ABHD19, ABHD20, ABHD21, ABHD22, ABHD23, ABHD24, ABHD25, ABHD26, ABHD27, ABHD28, ABHD29, ABHD30, ABHD31, ABHD32, ABHD33, ABHD34, ABHD35, ABHD36, ABHD37, ABHD38, ABHD39, ABHD40, ABHD41, ABHD42, ABHD43, ABHD44, ABHD45, ABHD46, ABHD47, ABHD48, ABHD49, ABHD50, ABHD51, ABHD52, ABHD53, ABHD54, ABHD55, ABHD56, ABHD57, ABHD58, ABHD59, ABHD60, ABHD61, ABHD62, ABHD63, ABHD64, ABHD65, ABHD66, ABHD67, ABHD68, ABHD69, ABHD70, ABHD71, ABHD72, ABHD73, ABHD74, ABHD75, ABHD76, ABHD77, ABHD78, ABHD79, ABHD80, ABHD81, ABHD82, ABHD83, ABHD84, ABHD85, ABHD86, ABHD87, ABHD88, ABHD89, ABHD90, ABHD91, ABHD92, ABHD93, ABHD94, ABHD95, ABHD96, ABHD97, ABHD98, ABHD99, ABHD100	28
4	ALB1, ALB1B, ALB1C, ALB1D, ALB1E, ALB1F, ALB1G, ALB1H, ALB1I, ALB1J, ALB1K, ALB1L, ALB1M, ALB1N, ALB1O, ALB1P, ALB1Q, ALB1R, ALB1S, ALB1T, ALB1U, ALB1V, ALB1W, ALB1X, ALB1Y, ALB1Z, ALB2, ALB3, ALB4, ALB5, ALB6, ALB7, ALB8, ALB9, ALB10, ALB11, ALB12, ALB13, ALB14, ALB15, ALB16, ALB17, ALB18, ALB19, ALB20, ALB21, ALB22, ALB23, ALB24, ALB25, ALB26, ALB27, ALB28, ALB29, ALB30, ALB31, ALB32, ALB33, ALB34, ALB35, ALB36, ALB37, ALB38, ALB39, ALB40, ALB41, ALB42, ALB43, ALB44, ALB45, ALB46, ALB47, ALB48, ALB49, ALB50, ALB51, ALB52, ALB53, ALB54, ALB55, ALB56, ALB57, ALB58, ALB59, ALB60, ALB61, ALB62, ALB63, ALB64, ALB65, ALB66, ALB67, ALB68, ALB69, ALB70, ALB71, ALB72, ALB73, ALB74, ALB75, ALB76, ALB77, ALB78, ALB79, ALB80, ALB81, ALB82, ALB83, ALB84, ALB85, ALB86, ALB87, ALB88, ALB89, ALB90, ALB91, ALB92, ALB93, ALB94, ALB95, ALB96, ALB97, ALB98, ALB99, ALB100	27



[2]

SmartR Demo

The screenshot displays the SmartR software interface. On the left is a navigation pane titled "Navigate Terms" with a search bar and a "Filter Clear" button. Below the search bar is a tree view containing the following items:

- Across Trials
- Demo Data
 - GSE1233 (800)
 - GSE4382 Modified (167)
 - Sorlie(2003) GSE4382 (167)
 - Time Series Data (200)
- GEO Studies

The main workspace is titled "Comparison" and contains two sub-panels, "Subset 1" and "Subset 2". Each sub-panel has "Include" and "Exclude" buttons, a "Clear Panel" button, and a dashed box with the text "DRAG YOUR CONCEPTS HERE". Below the sub-panels are "Save Comparison" and "Clear All Panels and Analysis" buttons. The eTRiKS logo is centered at the bottom of the workspace.

Navigation menu: Comparison Summary Statistics Grid View Advanced Workflow SmartR Data Export Export Jobs Workspace

Top right: Analyze UTILITIES

Ok, so why not just using R?

- Strong analytical component, but the visual capabilities are rather lacking.
- Possible Solution: Using R for analytics and the web browser for the visualisation.
- SmartR does just that!
- Pro: Highly dynamic and modern visualisations with strong analytical capabilities.
- Contra: This approach requires a deep integration with the web service → platform-bound

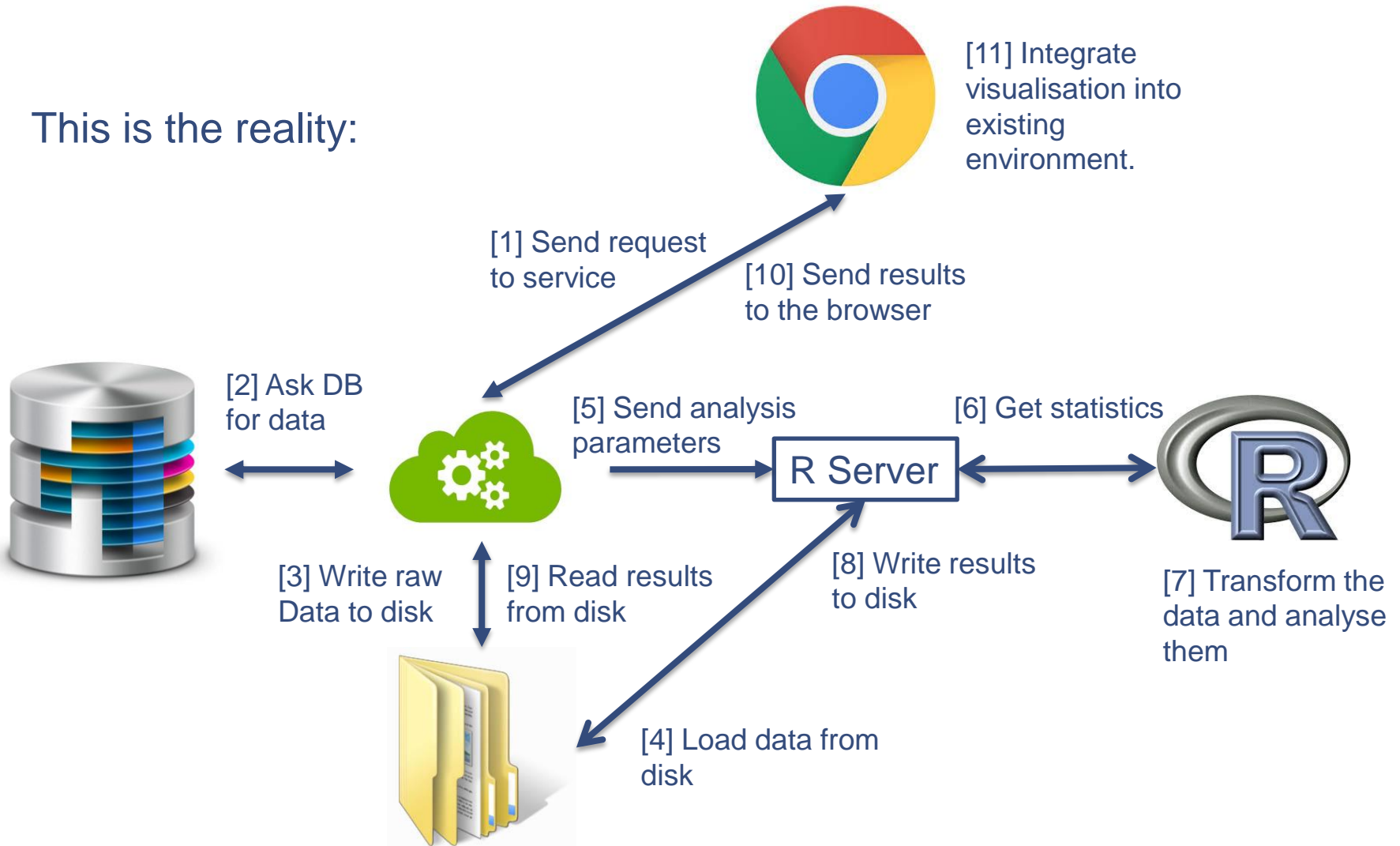
Why are visual analytics platform-bound?

This is what it looks like:



Why are visual analytics platform-bound?

This is the reality:



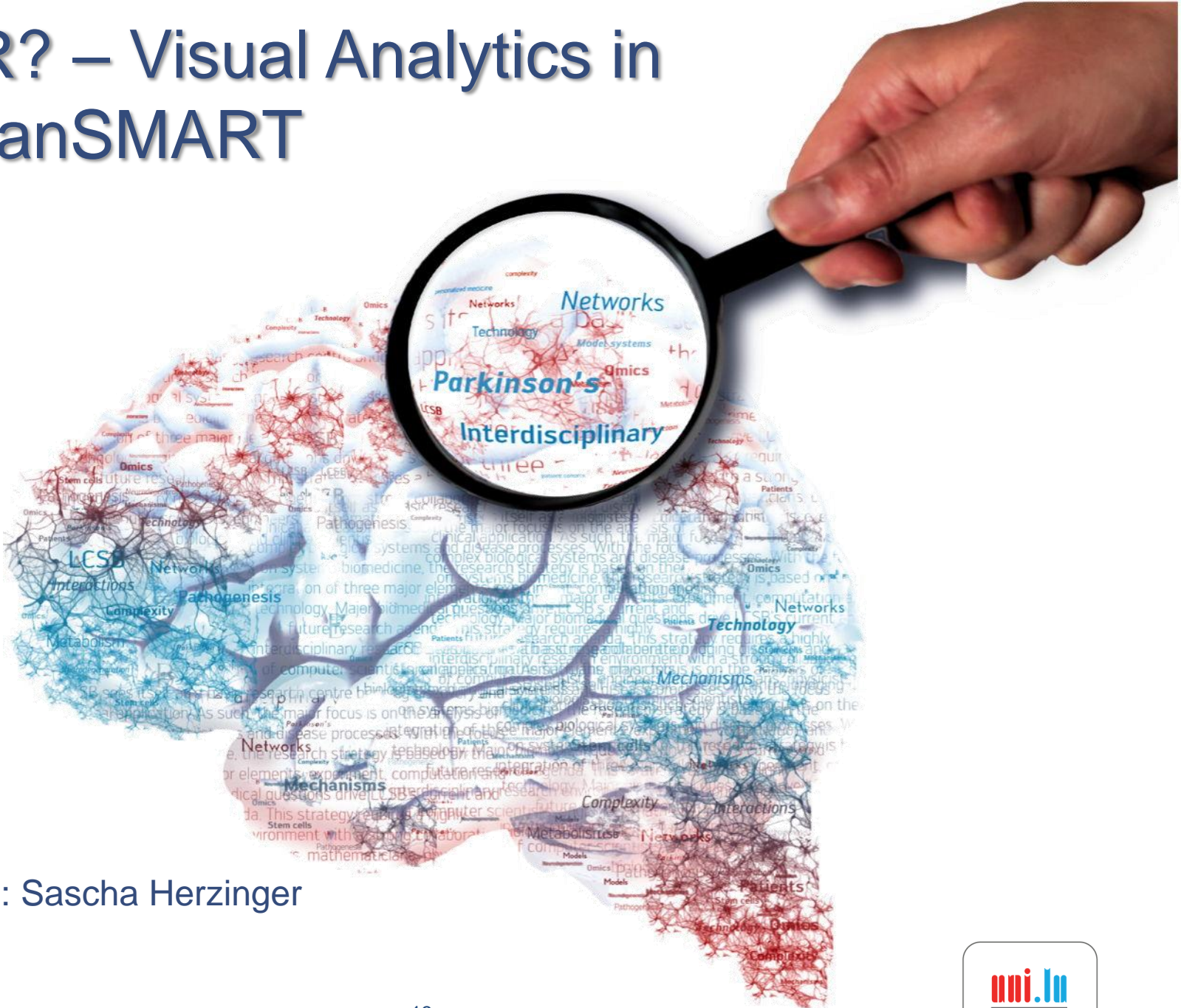
Why are visual analytics platform-bound?

- Things that have not been mentioned:
 - Session management
 - Clean-up services
 - Error handling
 - Job handling
 - Caching
- Main reasons for platform-bondage:
 - Different programming language (Groovy, Python, Scala, ...)
 - Different web framework (Grails, Django, Play, ...)
 - Different internal class structure and architecture

The future of SmartR

- Must resolve platform-binding
- Must support multiple upcoming UIs
- Needs a more scalable solution than R / Rserve
- Needs constant maintenance, due to changing interfaces
- Conclusion: **Dead End**

SmartR? – Visual Analytics in i2b2/TranSMART



Presentation: Sascha Herzinger

Fractalis – Scalable Platform-independent Visual Analytics

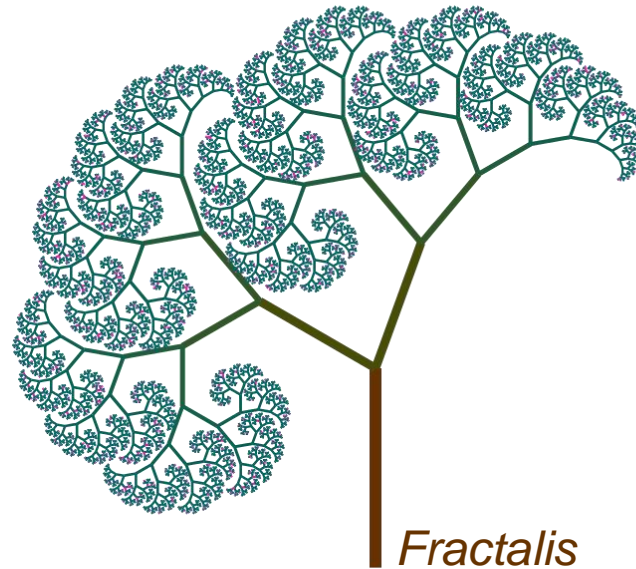


Presentation: Sascha Herzinger



A New Start

Name inspiration: https://en.wikipedia.org/wiki/Mandelbrot_set



Requirements:

- Scalable
- Extendable
- Platform independent
- Robust to changes
- Documented
- Well tested
- Simple to integrate

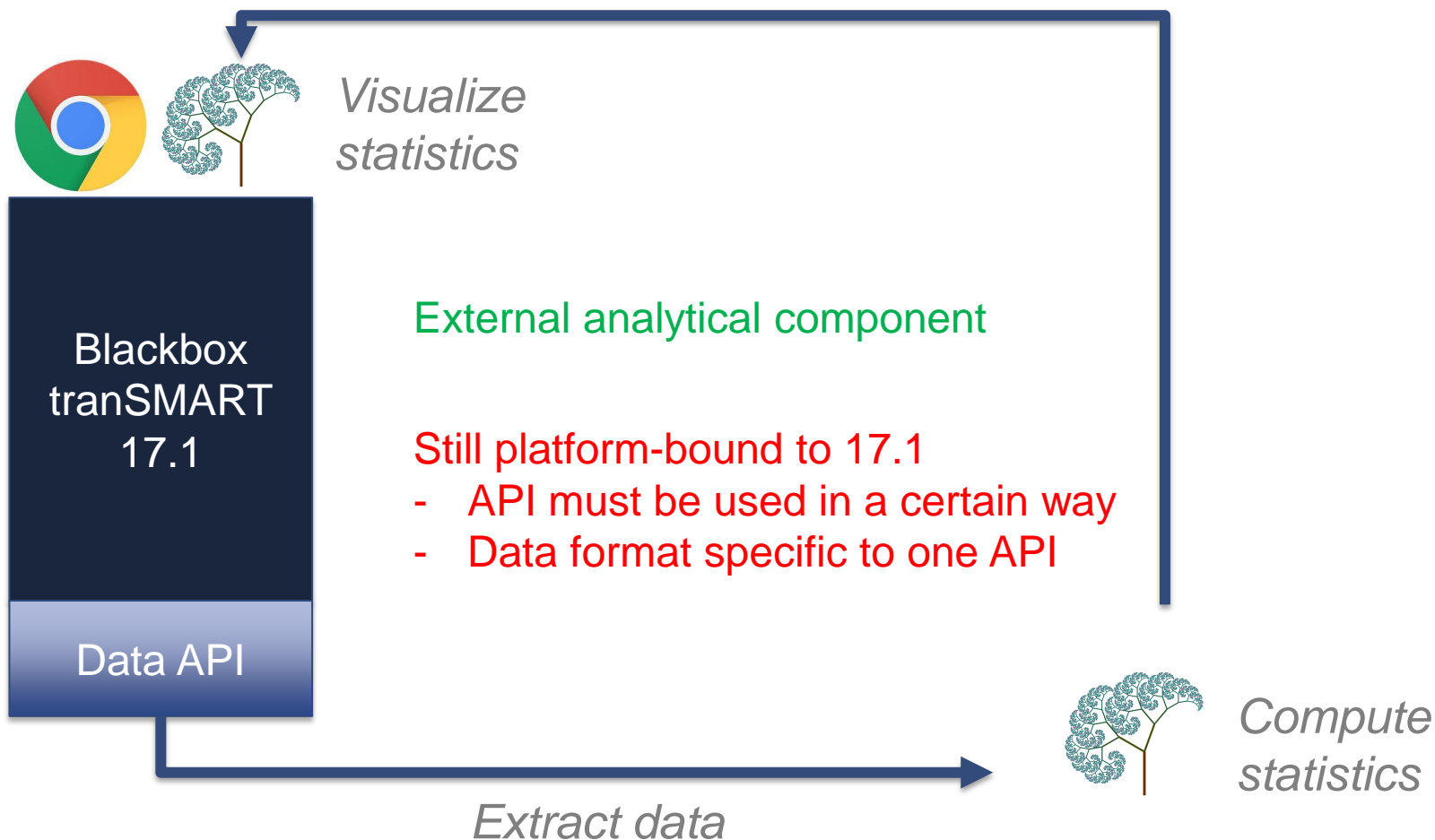
How to fulfil these new requirements?



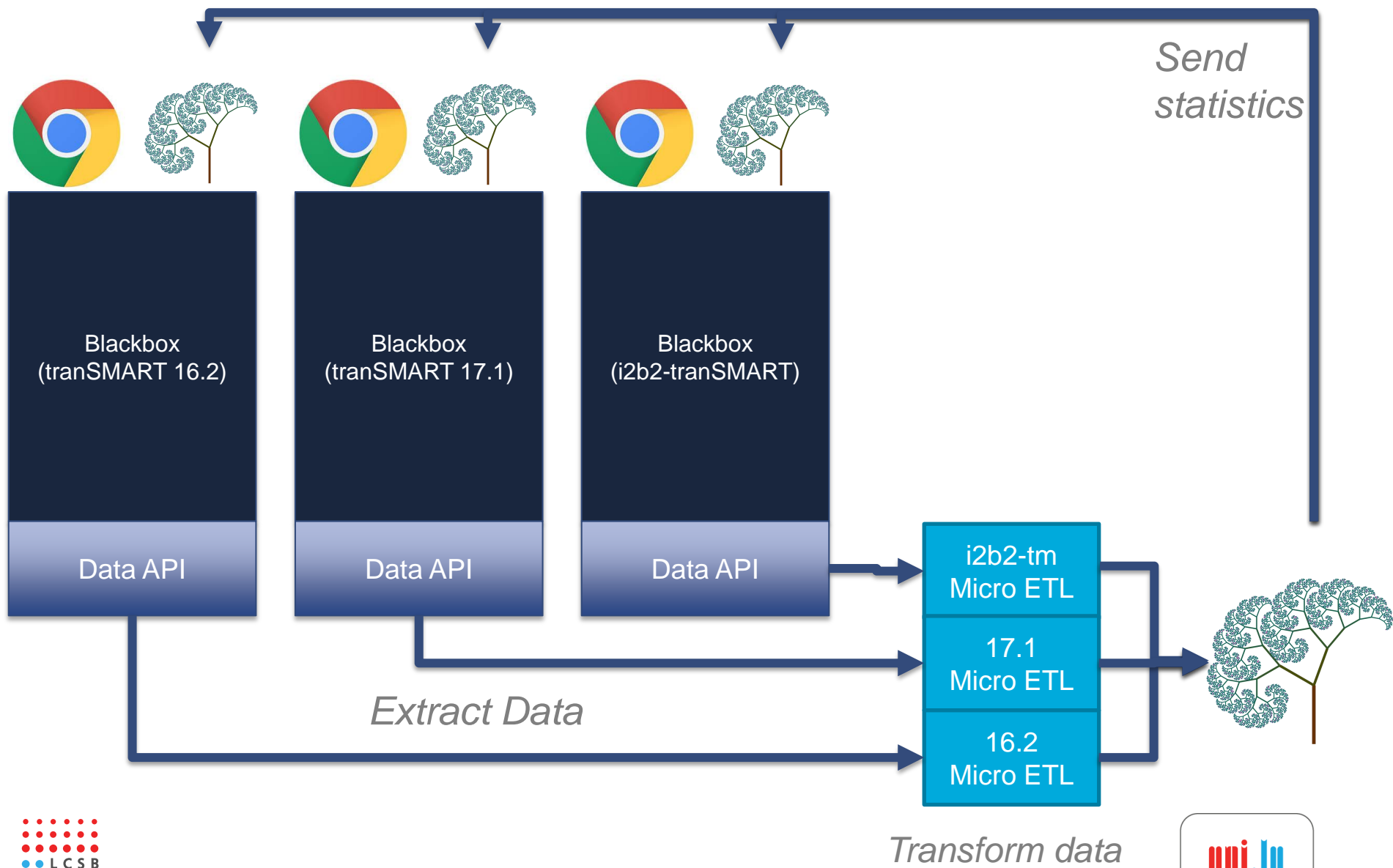
Blackbox

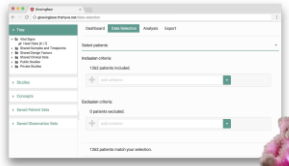
This means that we only care about what goes into this box and what comes out of it!

How to fulfil these new requirements?



How to fulfil these new requirements?





User Interface

Server

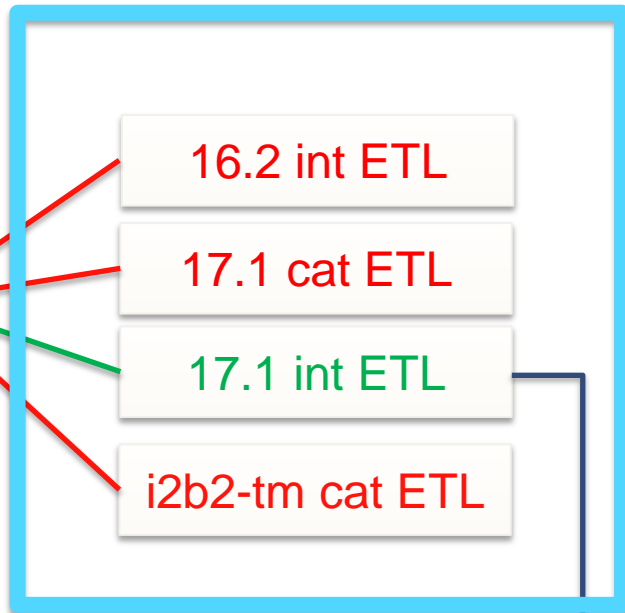


POST /data
 Platform: 17.1
 Data Type: Integer
 Field Name: Age
 Study: DeNoPa

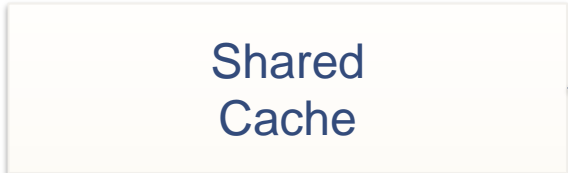
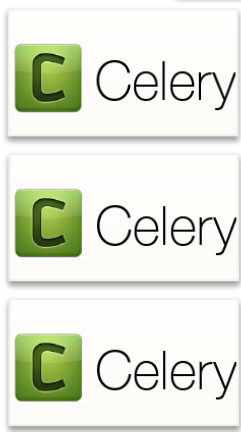
Robustness & platform independence



ETL Factory



Task ID: 1234567890
 Data type: numeric
 Location: /tmp/foo

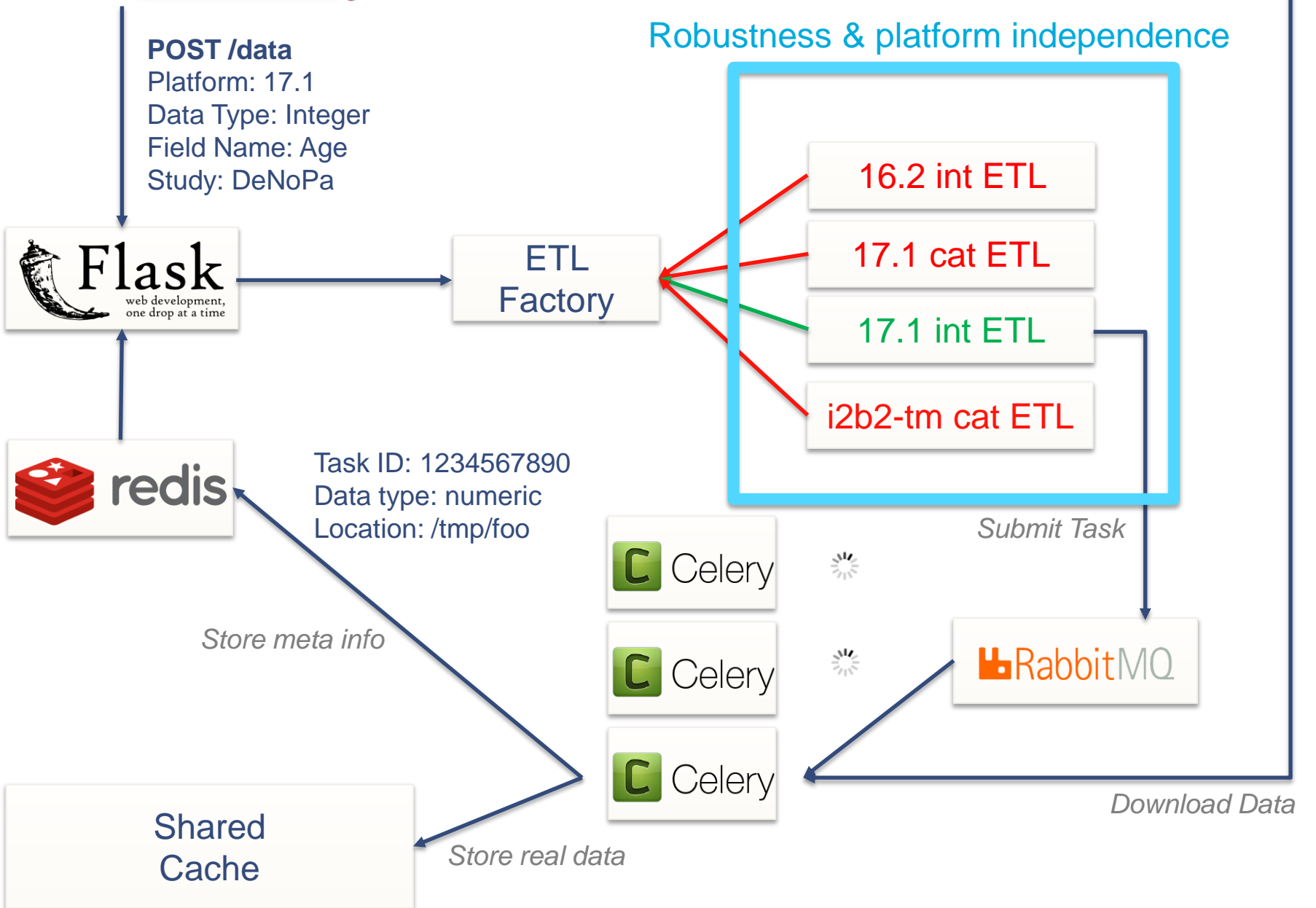


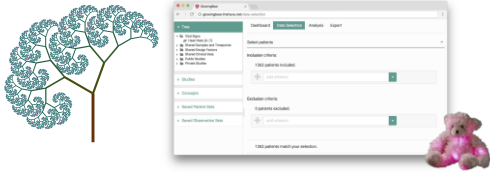
Store meta info

Store real data

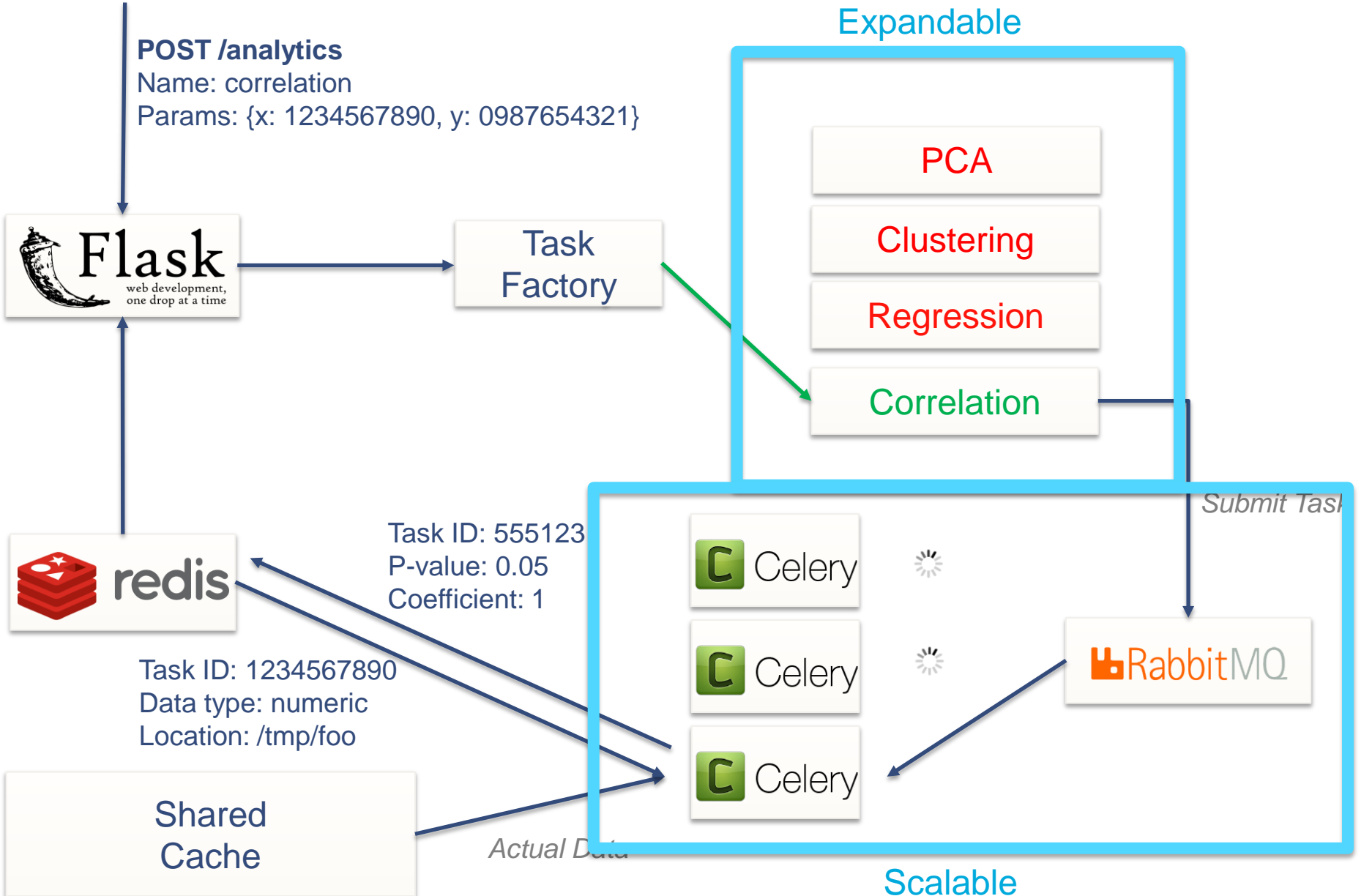
Submit Task

Download Data



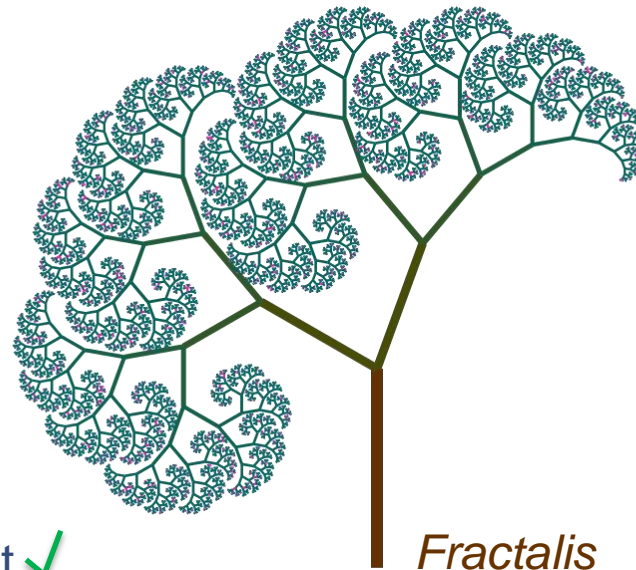


User Interface



A New Start

Name inspiration: https://en.wikipedia.org/wiki/Mandelbrot_set



Requirements:

- Scalable ✓
- Extendable ✓
- Platform independent ✓
- Robust to changes ✓
- Documented ✓
- Well tested ✓
- Simple to integrate ✓

add data delete data

Control Panel



data delete data

Control Panel



data delete data

Control Panel



Control Panel





data

delete data

Control Panel



Special Thanks

- To all my colleagues at the LCSB who gave me inspiration and advice
- To all the people and organisations I worked together with during the last two years (eTRIKS, The Hyve, ITTM, and many more)

Some important logos

