Controlled Interactivity
Lean-back media experiences based on lean-forward technologies

Ingar Arntzen, Njål Borch, Anders Andersen

Systems Research: Multimedia

- Capture
- Formats, compression
- Distribution
- Rendering
- Streaming protocols, services
- CDN's
- 360 video
- VR, AR, XR
- AI

Mostly about video!

FTC 2023 - Future Technologies Conference 2023
2-3 November 2023 | San Francisco, United States

State Trajectory

A Unifying Approach to Interactivity with Real-Time Sharing and Playback Support
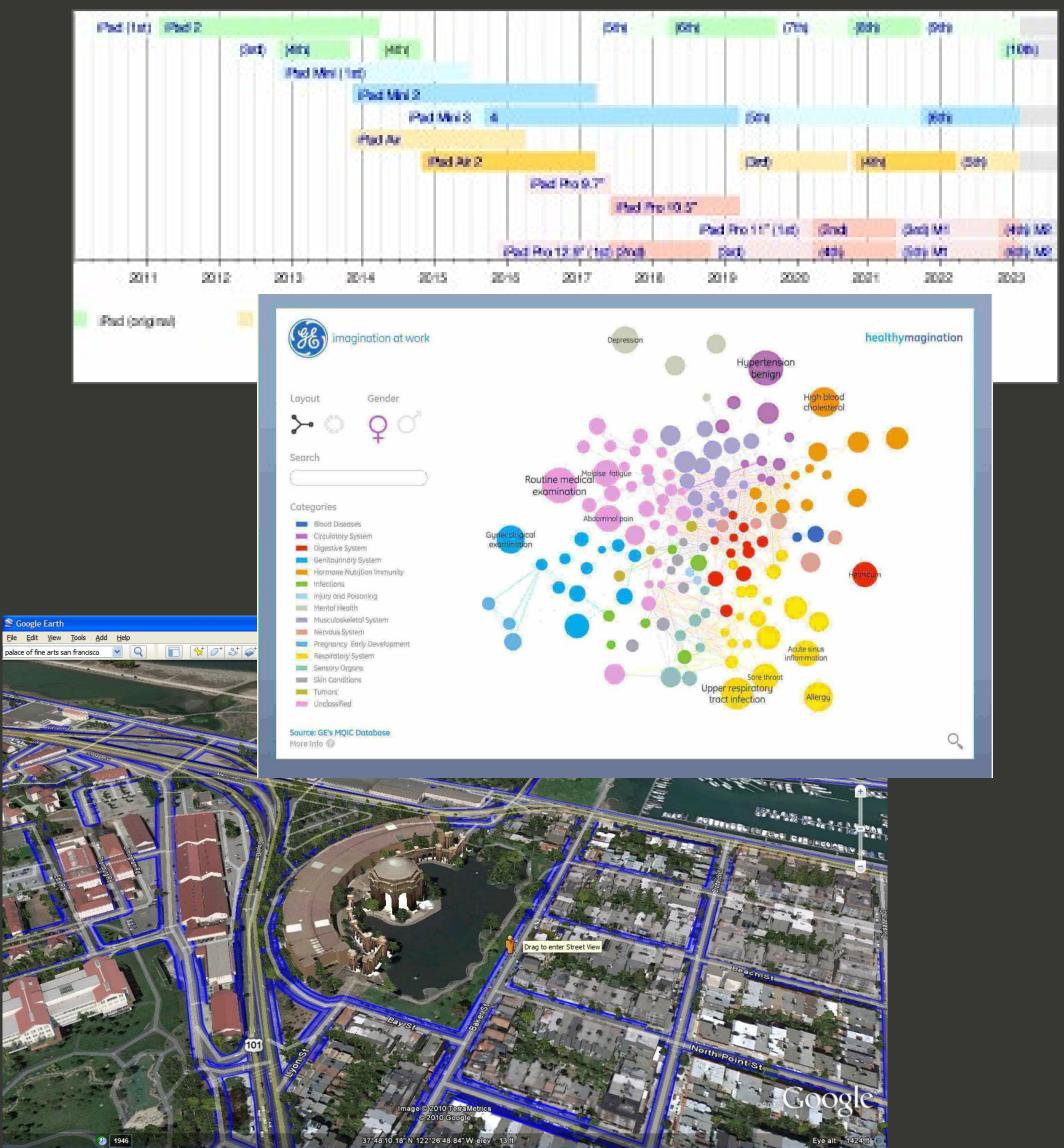Ingar Arntzen, Njål Borch, Anders Andersen

Interactive Render Tools

exploration and content creation

- selection, filtering, customization, navigation
- instant feedback

scroll, zoom, pan, adjust, rotate, tilt, animate, rewind, play, toggle, next, drag, hide, re-order, unmute, center, slide

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Lean-forward	Lean-back
Maps, timeline, dataviz, piano …	TV, radio, video, podcast, theatre…
●User is active ●Tell your own story	●User is passive ●Someone else tells a story

Idea

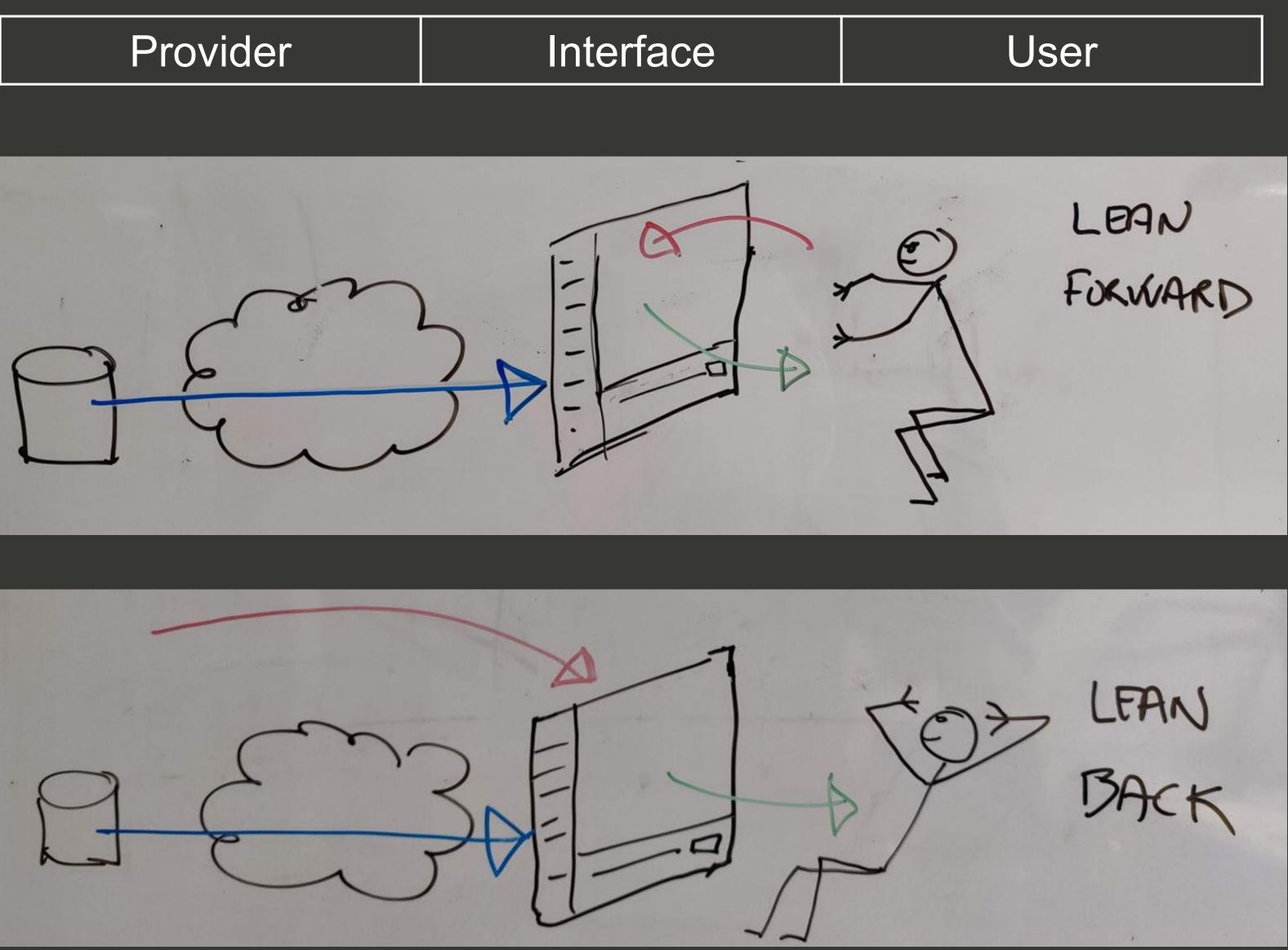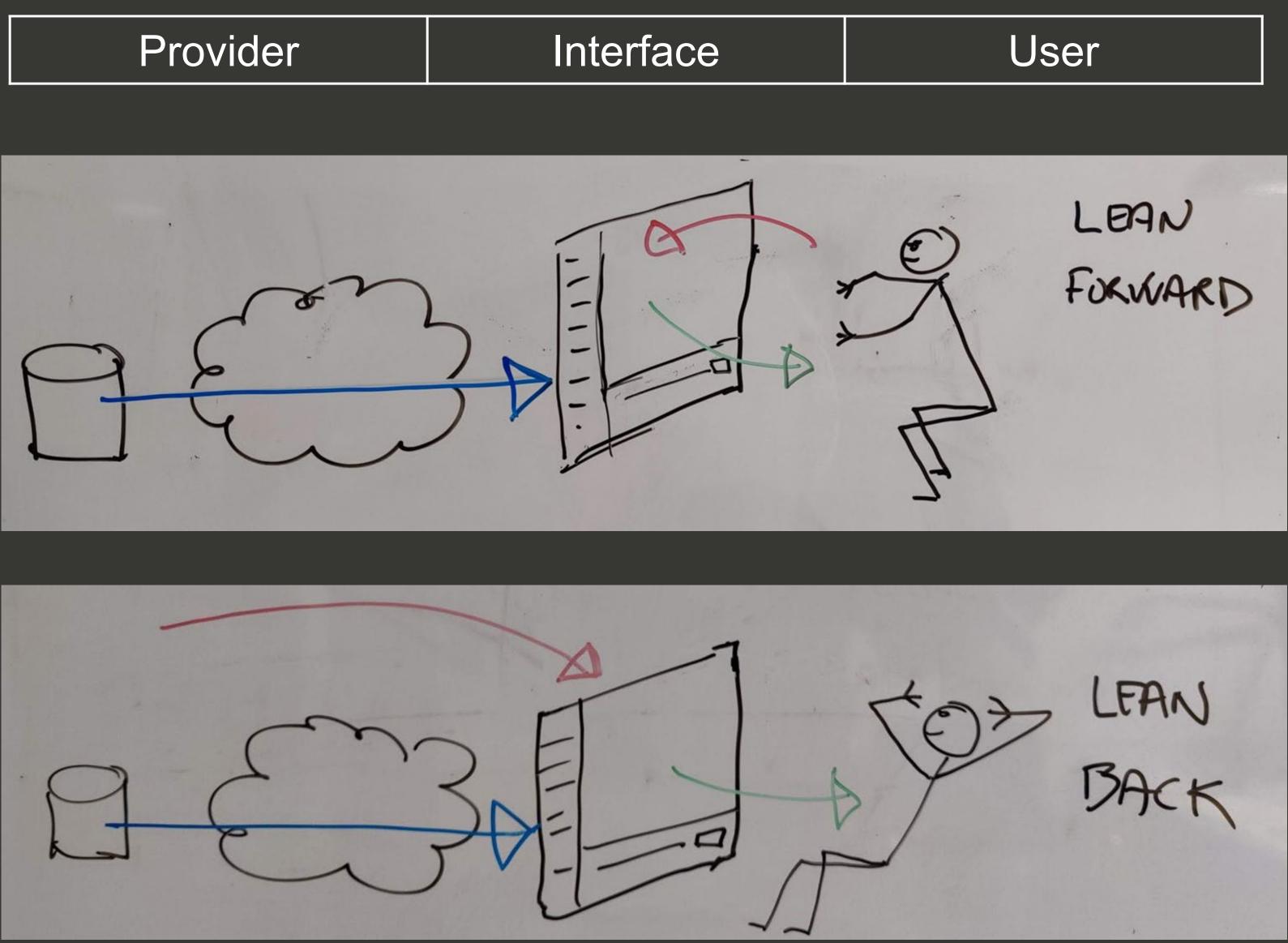| Provider	Interface	User

Using lean-forward tools for lean-back experiences?

Problem

Remote control the user experience ?

Why?

Lean-back storytelling - with all the advantages of lean-forward technologies
- adaptation, customization, personalization, interactivity, lightweight, real-time data sources, powerful rendering tools
- flexibility of technology appears to be under-exploited!

Automation
- AI's and LLM's are excellent for content production
- What if they could tell stories by remote controlling our lean-forward interfaces?

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Example Application

- Parallell presentations
  - Video/Audio + Interactive UI
- Visual Radio/Podcast
  - HOST:
    - play with interactive tool while recording audio
  - VIEWER:
    - tap into interactive visuals while listening
    - pivot official narrative vs private exploration

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Challenges…

- share control over Internet in-real time?
  - latency, bandwidth, …
- support support dynamic control signals?
  - transitions, animations, pointer-driven control, …
- support timeline consistency?
  - playback with a media timeline?
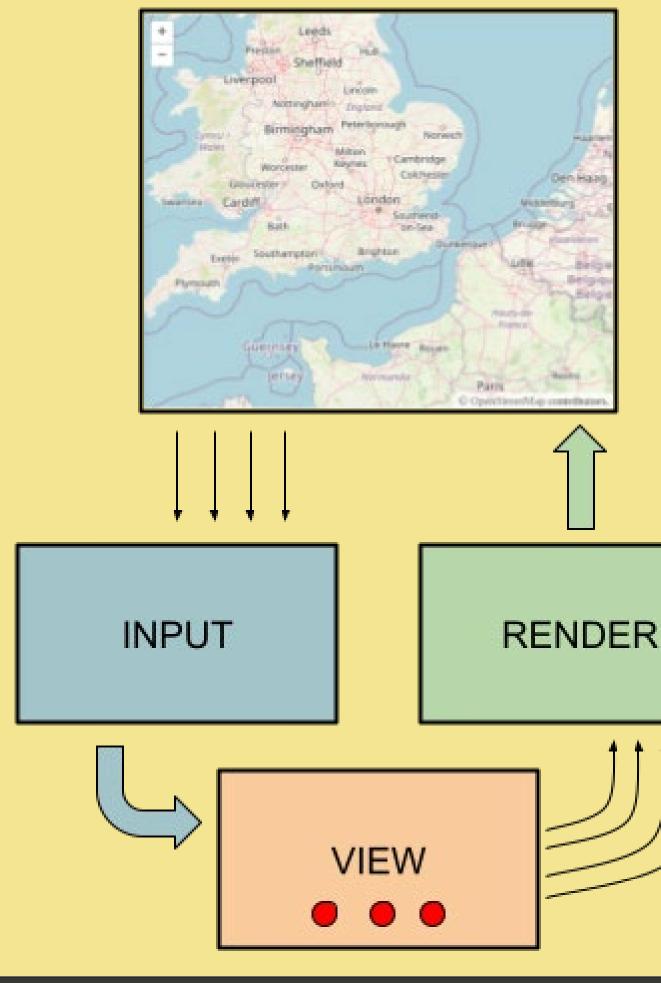 - live, time-shifted or on-demand?

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Related Work

Frameworks for animation and timed rendering

Distributed Synchronization

Data-driven control
- e.g feed, playlist -> primitiv, limited to data

Collaboration & Multiplayer Games
- e.g. miro, unity, unreal -> real-time control

Media
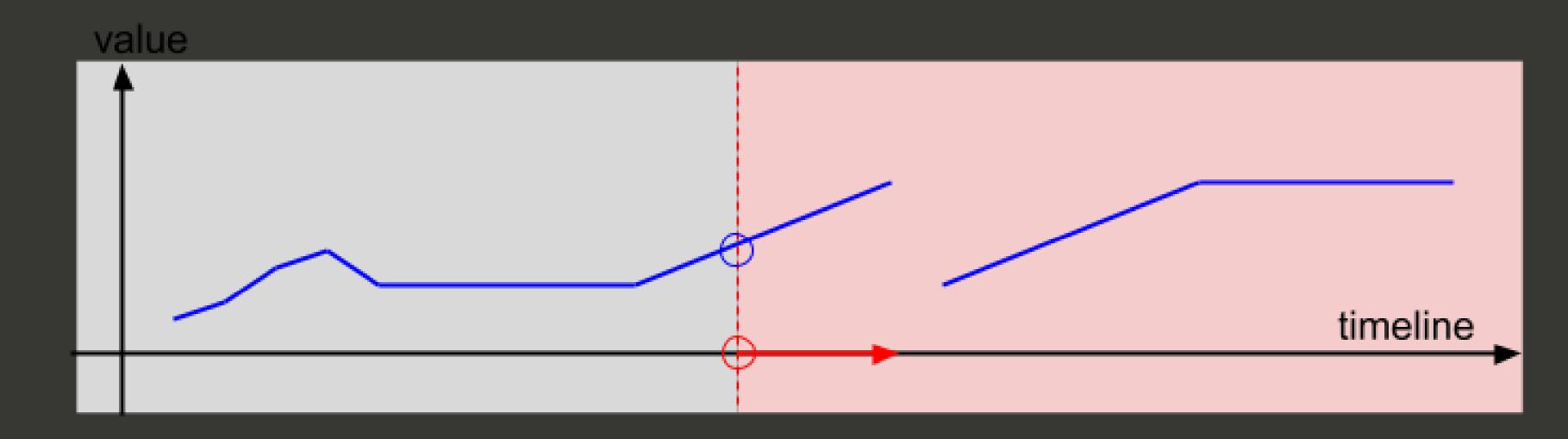**Futures** ●

Test Case

- How to remote control a 2D Map?
  - Demanding test case
- Control
  - internal variables (lat, lon, zoom)
  - animations for smooth transitions
- Idea
  - sharing variables online => COLLABORATION
  - rewinding and replaying variables => LEAN-BACK

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Contribution

State Trajectory

- variable with timeline

- track control state through time
  - e.g. {lon, lat, zoom}
- built-in support
  - online sharing, dynamic state change, time-shifting and playback
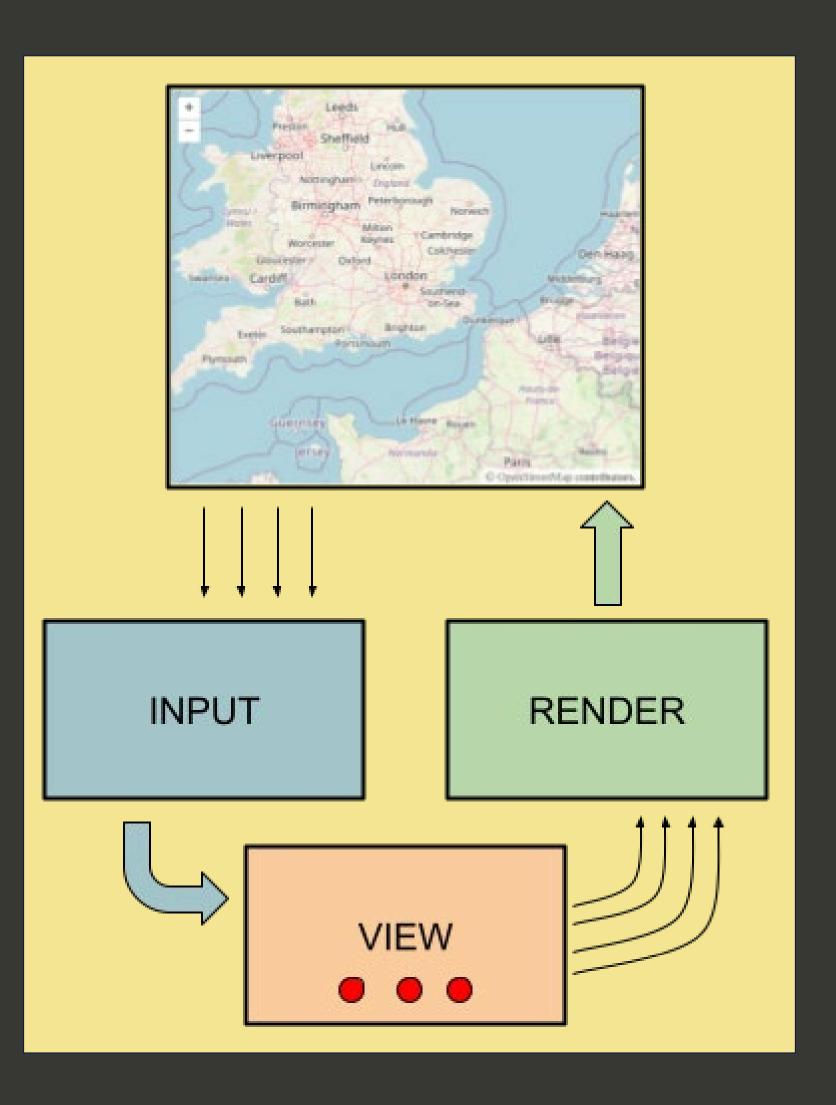
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Evaluation

- ## Integration OpenLayers Map
  - replace internal variables (lat, lon, zoom) with state trajectories
  - framework agnostic to changes
- ## Support all standard map controls
- ## New Capabilities
  - MapConference => Real-time map collaboration
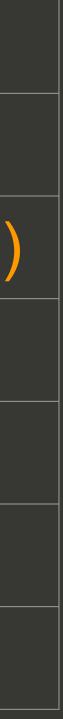 - MapCast => Replay map-session with media

API

	Observable Variable	State Trajectory (cursor)
Update	a.value = new_value	a.value = new_value
		a.trans (from, to, duration)
		a.sample (value)
Access	a.value	a.value
		a.dynamic
Observe	a.on("change", cb)	a.on("change", cb)

+ timeline controls API (TimingObject)

Key takeaways

- Key idea - control as a (online) resource
- State Trajectory
  - Generic concept - nothing to do with maps!
  - Built-in support: real-time control sharing, transitions, timeline playback
  - Simple usage - similar to programming variables
  - Control as a Service?
- Step towards lean-back storytelling with powerful interactive technologies!

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Thank you
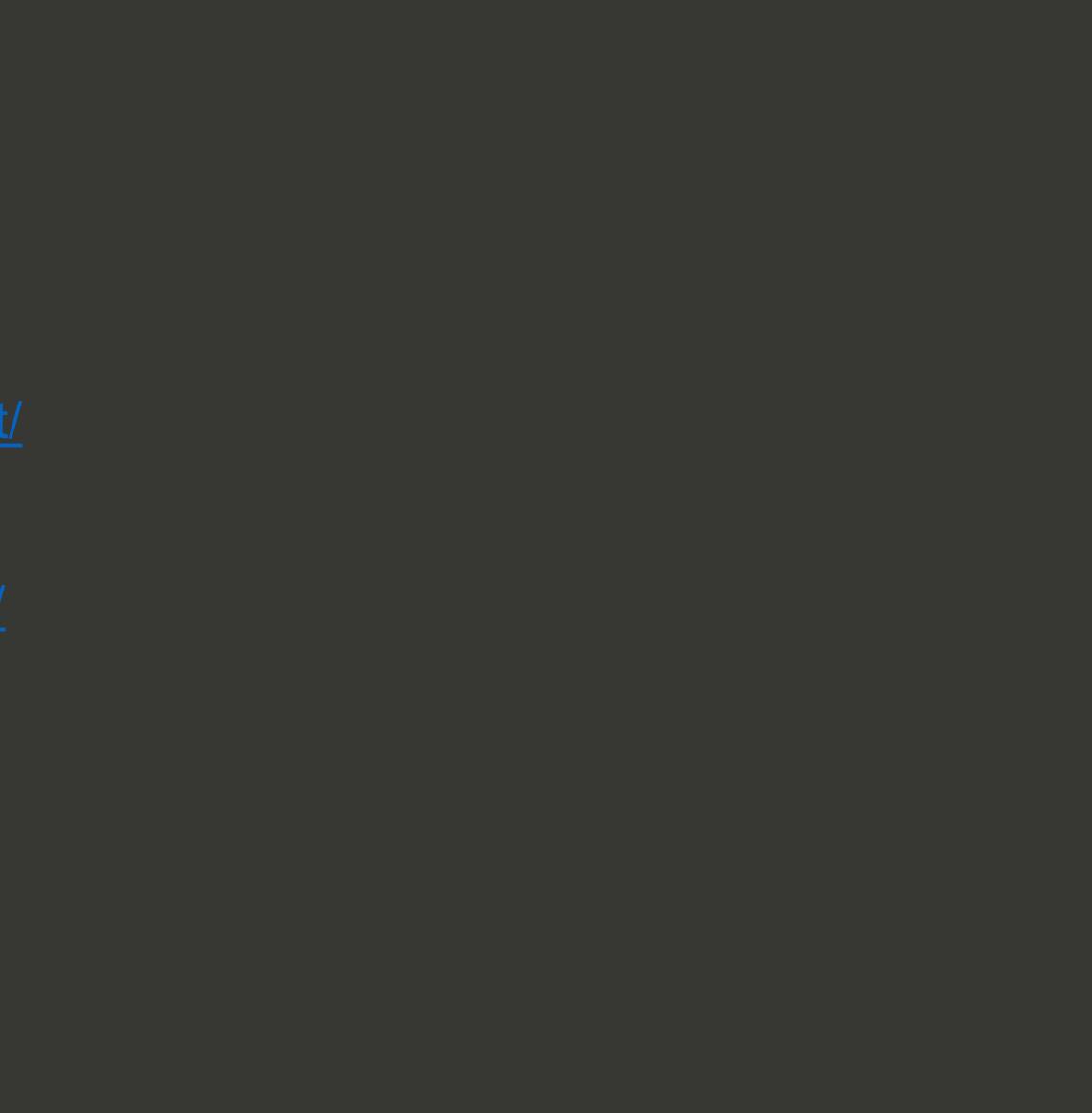## for your attention

Contact information:

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Demos

Map Cast
https://ovar.norceresearch.no/demo/ol/cast/

Map Collaboration
https://ovar.norceresearch.no/demo/ol/coll/

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Part 2 - Bigger picture

- **User demands diversifying in media**
  - One-size-fits-all broadcast?
  - Multi-device immersion?
  - Customize experiences?
  - Accessibility features?
  - Personalized coverage?
  - Interactive data visualization?
  - Social integration?
    - Bleeding live or improved on-demand?
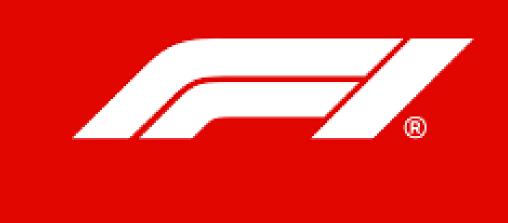- **Solution ?**
  - parallel coverage on multiple platforms

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Example: Formula 1 (F1)

- F1 TV World Feed
  - Professionally produced broadcast channel - global audience
- F1 TV - Web streaming with 20+ channels
  - a few produced channels
  - various camera angles from cars and track
  - timing information ++
- F1 App
  - interactive visualizations of race statistics
    - pit stops, overtakes, tire wear, gas levels, …
  - Interactive map with race track and cars
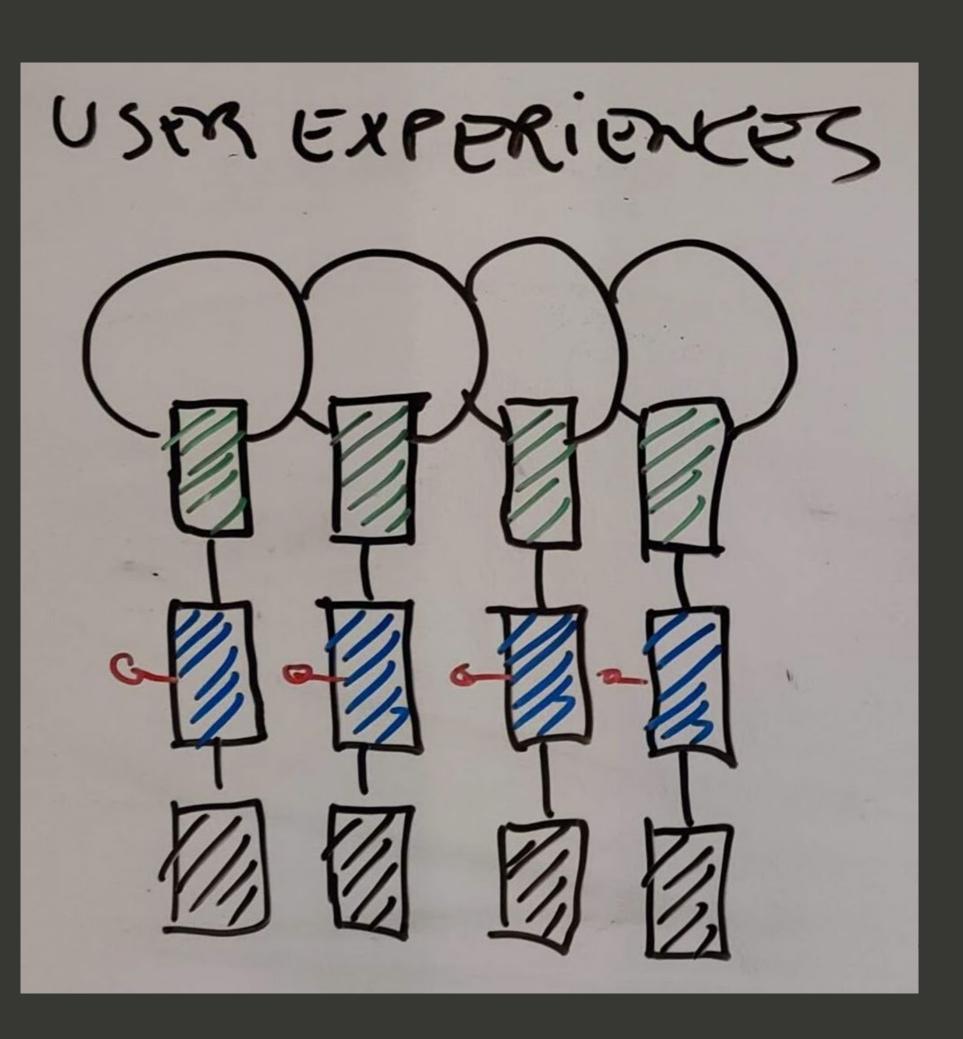   - playback of vehicle gps tracks
  - Social commentary

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Combined Usage?

- F1 World Feed + F1 TV + F1 App
- Issues
  - manual setup
  - conflicts and no coordination
  - differences in delay
  - no help finding the good bits
- Reasons
  - independent platforms
  - independent user experiences
  - production partly shifted to consumer

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Cross-platform media experiences

- Single user experience, across platforms
  - Production tells a story across all interfaces, consistent with a common timeline and narrative
  - User may lean back or engage. Interactivity affects the experience as a whole

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Some challenges…

- How to remote control interactive interfaces?
- How to coordinate between interfaces?
- How to ensure timeline consistent rendering in data-driven interfaces?
- How to control things differently for different people?
- How to ensure quality and brand control?
- How to keep costs and complexity down?
- How to automate?
- How to build this on top of existing infrastructure?

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Hypothesis

- Control seems to be a recurring theme…
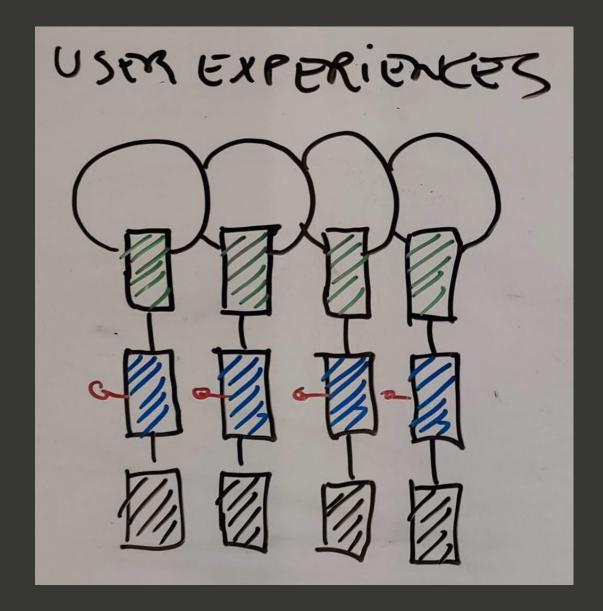- Generic support for cross platform can be addressed as a fundamental feature of the media model.

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New Media Model?
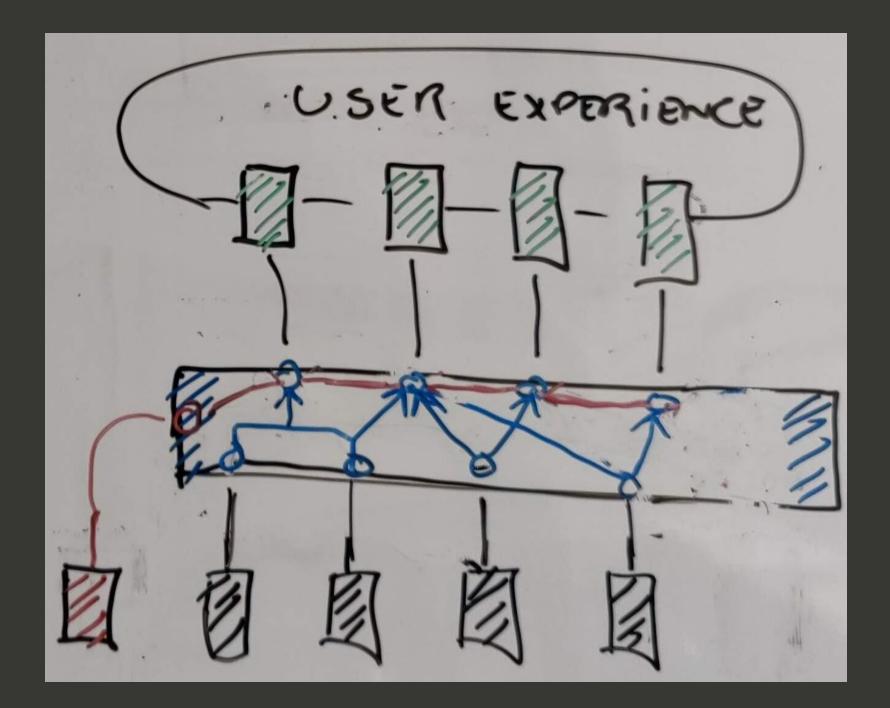
- Control as key concept
  - online resource
  - timeline consistency, time-shifting
- Virtual state layer
  - Conversion of data to rendering state
  - Driven by control resources
  - => consistent rendering
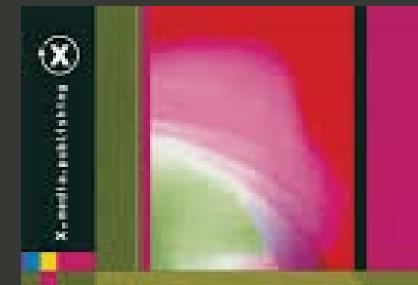- Infrastructure for data access and rendering unchanged.

Academic interest

- Control has been a peripheral theme in media systems research.
- We think it should be center stage.

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Thank you
for your attention

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