Immersive Computing

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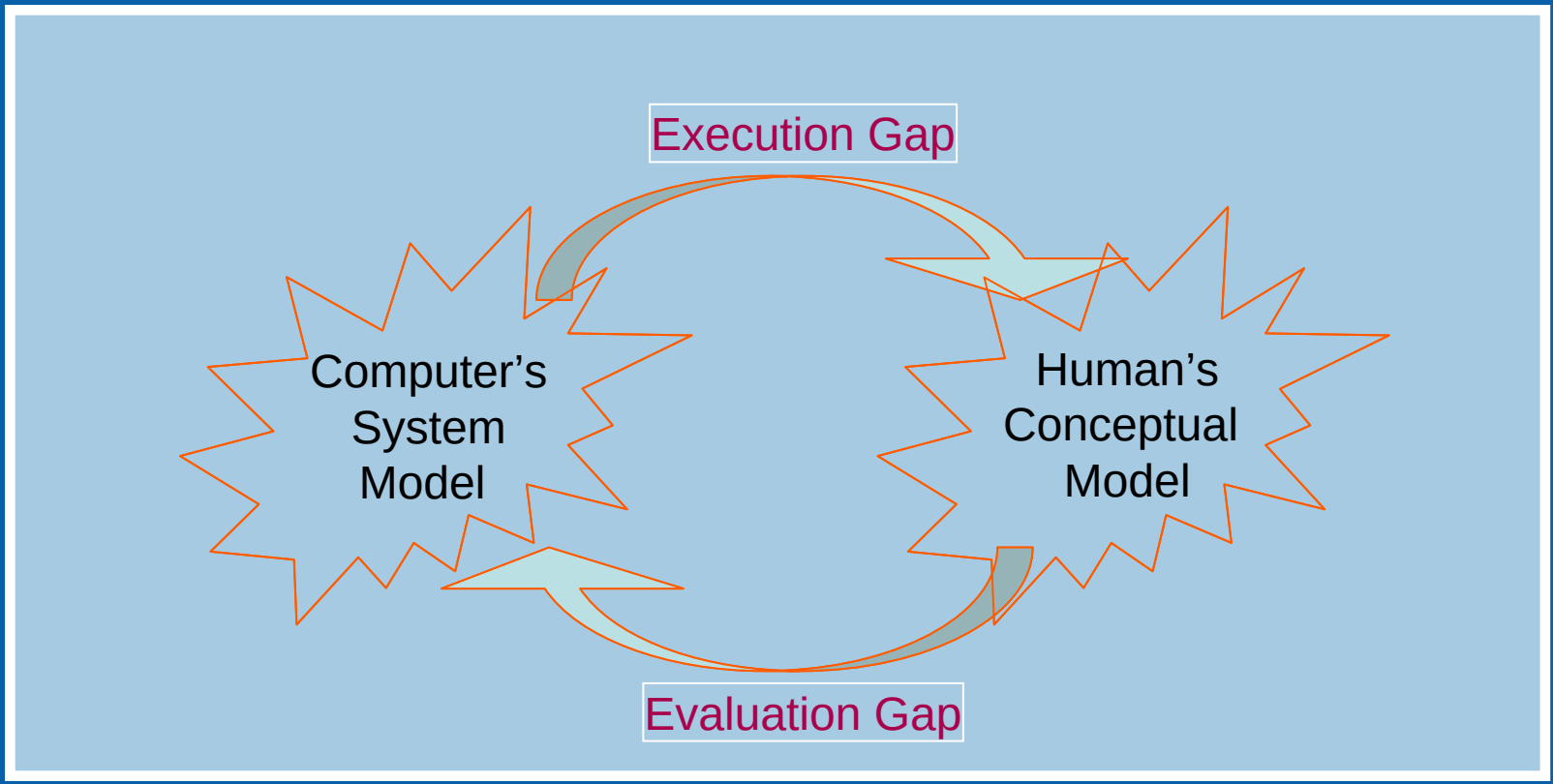
Immersive Computing Challenge

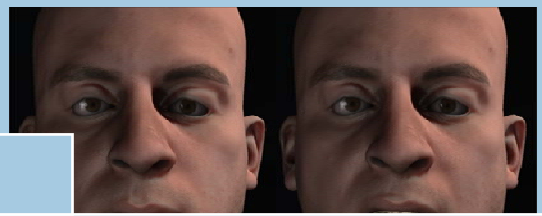
Norman's Gulf

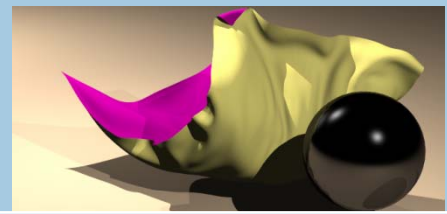


Can Norman's Gulf be bridged?

Three Stages of Immersion

Sensory Immersion





Behavioral Immersion

Rendering
Simulation

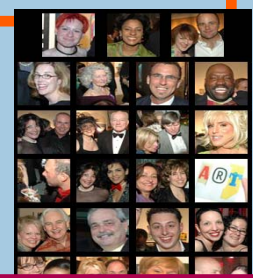
Machine learning
Neural networks
Probabilistic reasoning

Fuzzy logic
Belief networks

Super Immersion

Trade Bots

Outer loop:
iRMS Visual Loop:
One Per Real User



Chat Bots

Inner Loop:
iRMS Analytics Loop

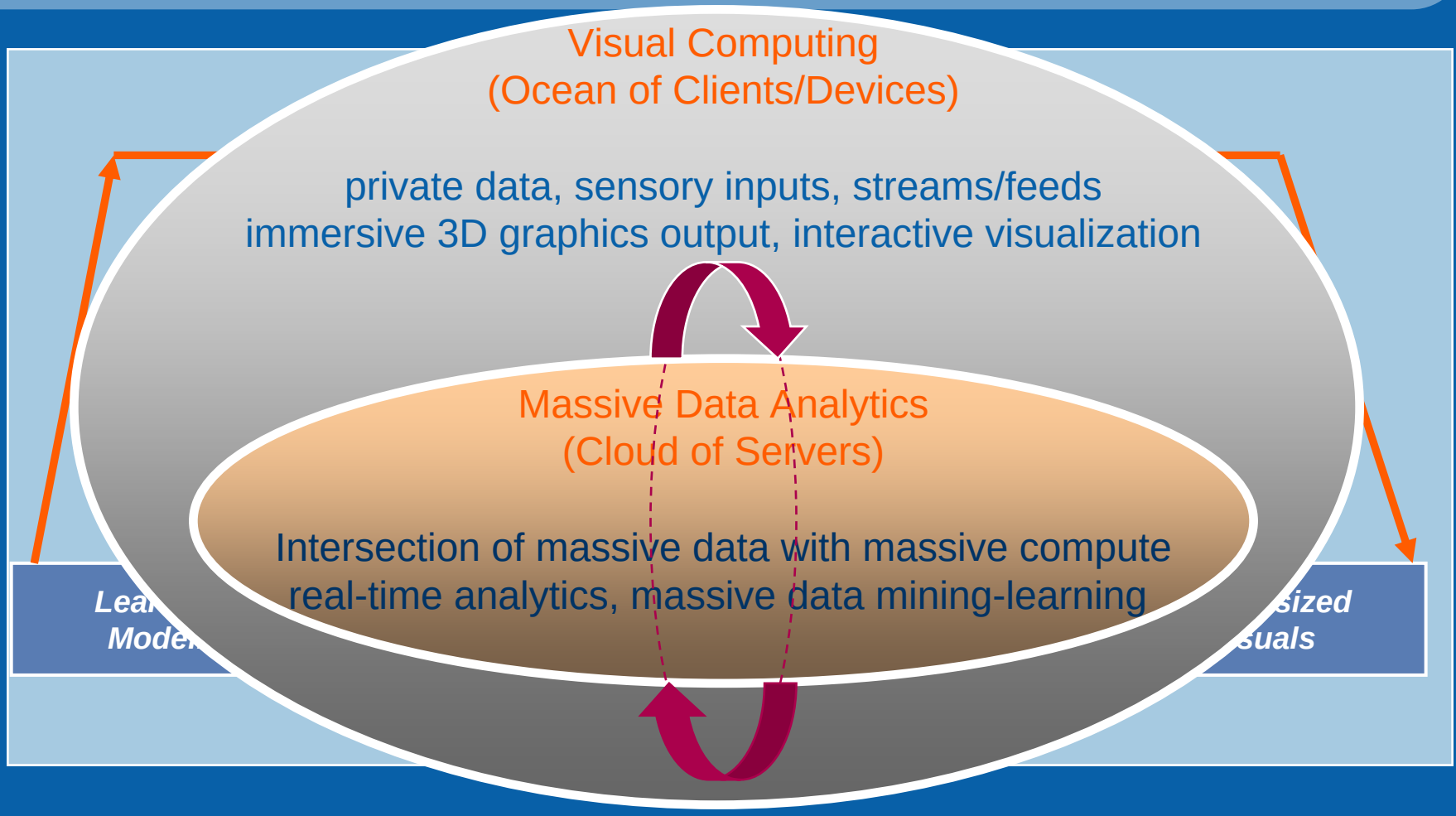
Shop Bots

Performance Needs:
Can far exceed typical i/o limits of human perception

Computational requirements are huge, but …

Limited by input/output limits of human perception

Where is my computer?



… Architectural implications are far more radical

Computational substrate must undergo a sea-change!

What are we doing?

Level 1: Applications				
Ad-hoc search	...	Derivative Pricing	Ray-Tracing	Computer Vision
Semantic Search	Portfolio Selection	...	Physical Simulation	...
Level 2: Mathematical Models				
Partitioning Based	...	Diffusion Models	Level Sets	Tracking &Reconstr.
Generative non-linear	Quadratic Optimization	...	Particle Systems	...
Level 3: Mathematical Techniques				
SVD	...	Interior-Point Method	Collision Detection	Path Planning
K-means	Stochastic Simulation	...	Filtering&Anti-Aliasing	...
Level 4.1: Numerical Algorithms				
Direct Solvers	Iterative Solvers	Monte Carlo Simulation	Convex Collision (V-Clip, GJK)	
Level 4.2: Numerical Primitives and Data Structures				
Sparse BLAS123	Dense BLAS123	Structured matrix operat.		
Sparcity struct. (CRS, graphs, elimination tree	Basic geometry primitives (triangle, box, convex)	Partition structures (grids, kd-tree, BVH)		

Workload-driven Architecture Research

SAAR (Scalable Applications and Architecture Research)

Summary

- *Connected Computing*
  - It's all about three C's (above + content or data)
- Architectural Challenge
  - Moving the data real-time to where compute happens
- Algorithmic Opportunity
  - Massive data approach to traditional compute problems

Thank You