System Considerations in Real Time Video QoE Assessment

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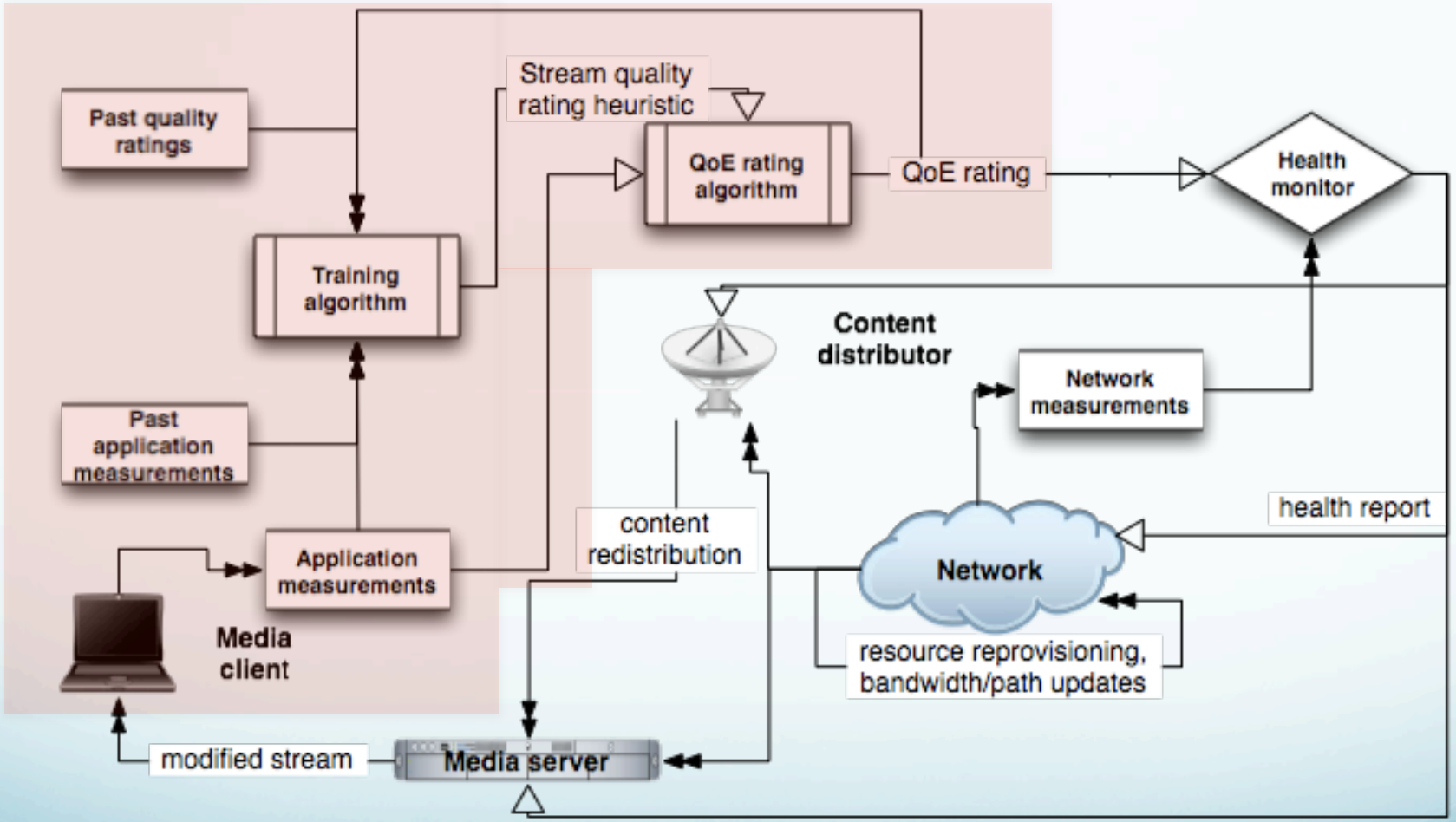
Outline

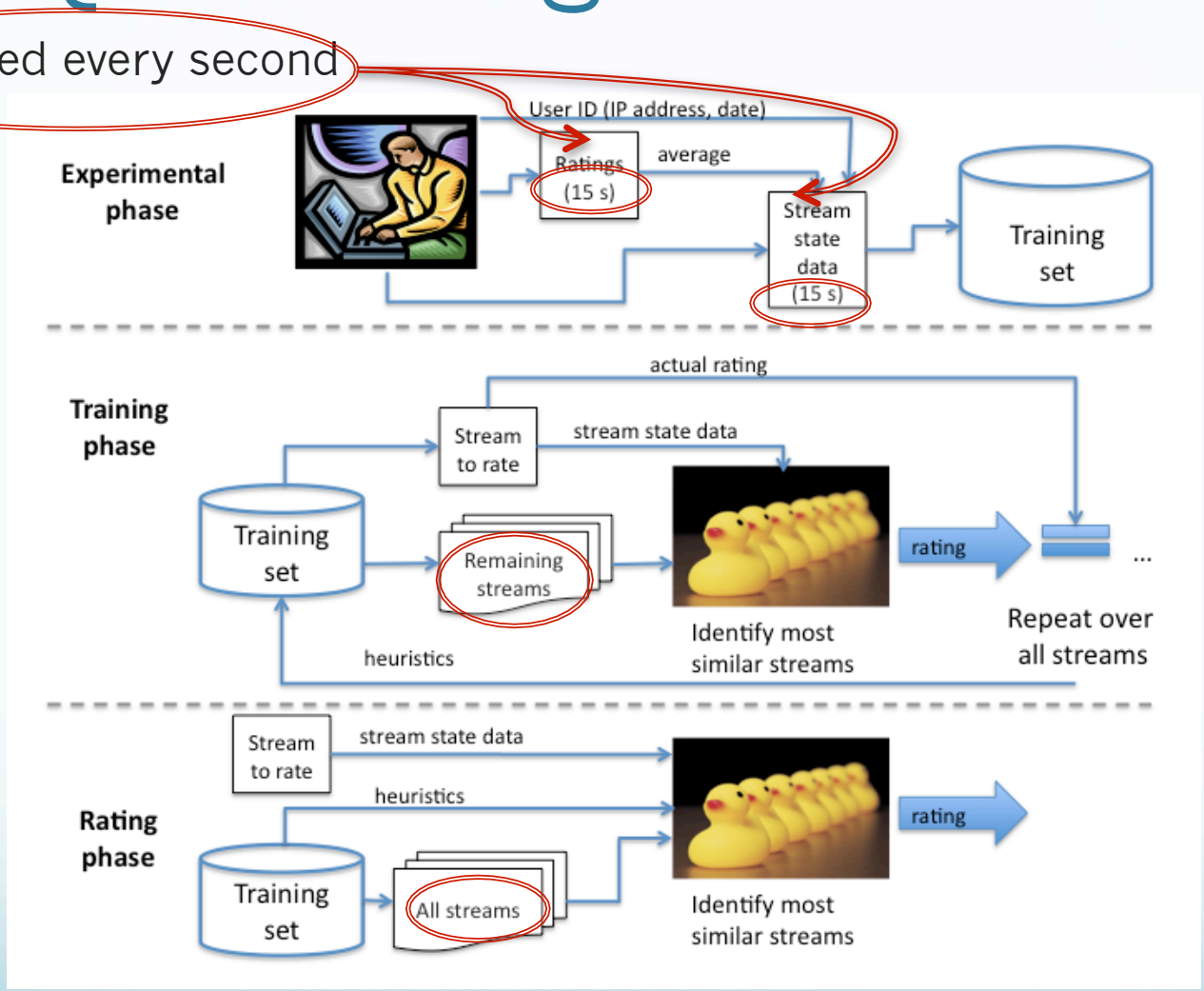
- Architectural overview
- Design tradeoffs and scenarios
- Results
- Conclusions and future work

QoE assessment architecture



Goals: Improve system performance, better protocol/network support for Internet video

QoE rating architecture

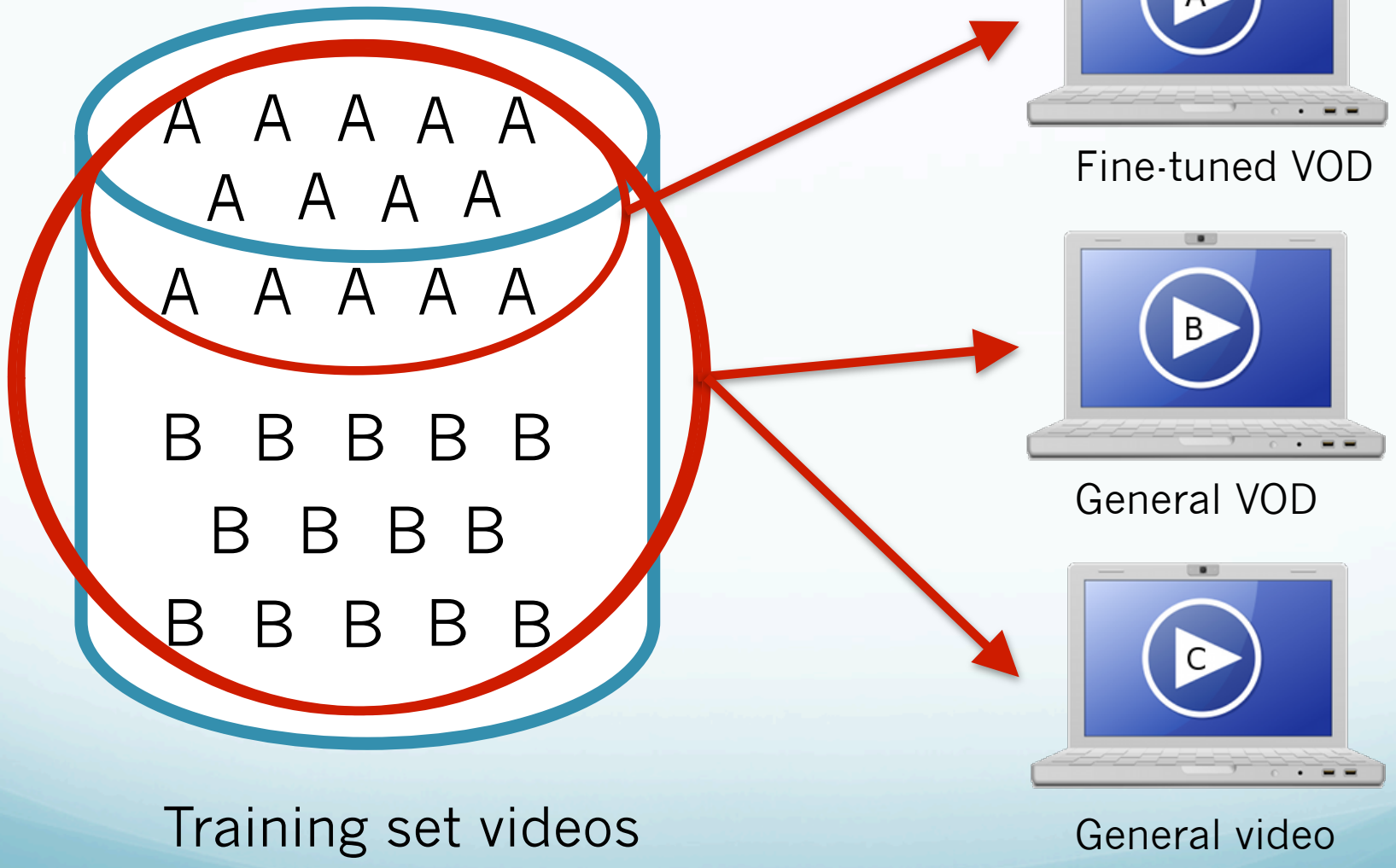


Goal: Examine the data-related design tradeoffs at various points in the rating architecture

Design tradeoffs

Tradeoff	Description	Considerations	Range
Sampling rate	Time between data samples	Missing key congestive events vs. resource utilization	1-5 sec
Interrating time	How much of a stream's data to examine before assigning a rating	False positives/ negatives vs. missing key congestive events	10-60 sec
Stream state data combos	How many pieces of data to use at once, and in what configurations	"Noisy" data vs. inaccurate data	1, 2, 3, all 4
Training set composition	Whether to target the training set to the stream to rate or use all data in the training set	Better chance of a match vs. resource utilization	See "scenarios"
Timing concerns	Time to train the system before rating commences	Flexibility vs. accuracy	Fix sample rate at 1 sec, vary interrating time

Scenarios


A A A A A
A A A A
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B B B B B
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A
B
C
Fine-tuned VOD
General VOD
General video
Training set videos

Experimental data

Name	Time (MM:SS)	Description	Action level
cow	1:57	dialog	moderate: frequent scene shifts
okgo	3:06	music video	moderate: stable scene, heavy action
up	4:40	animated movie short	high: frequent scene shifts, heavy action

Results: Top individual scenarios

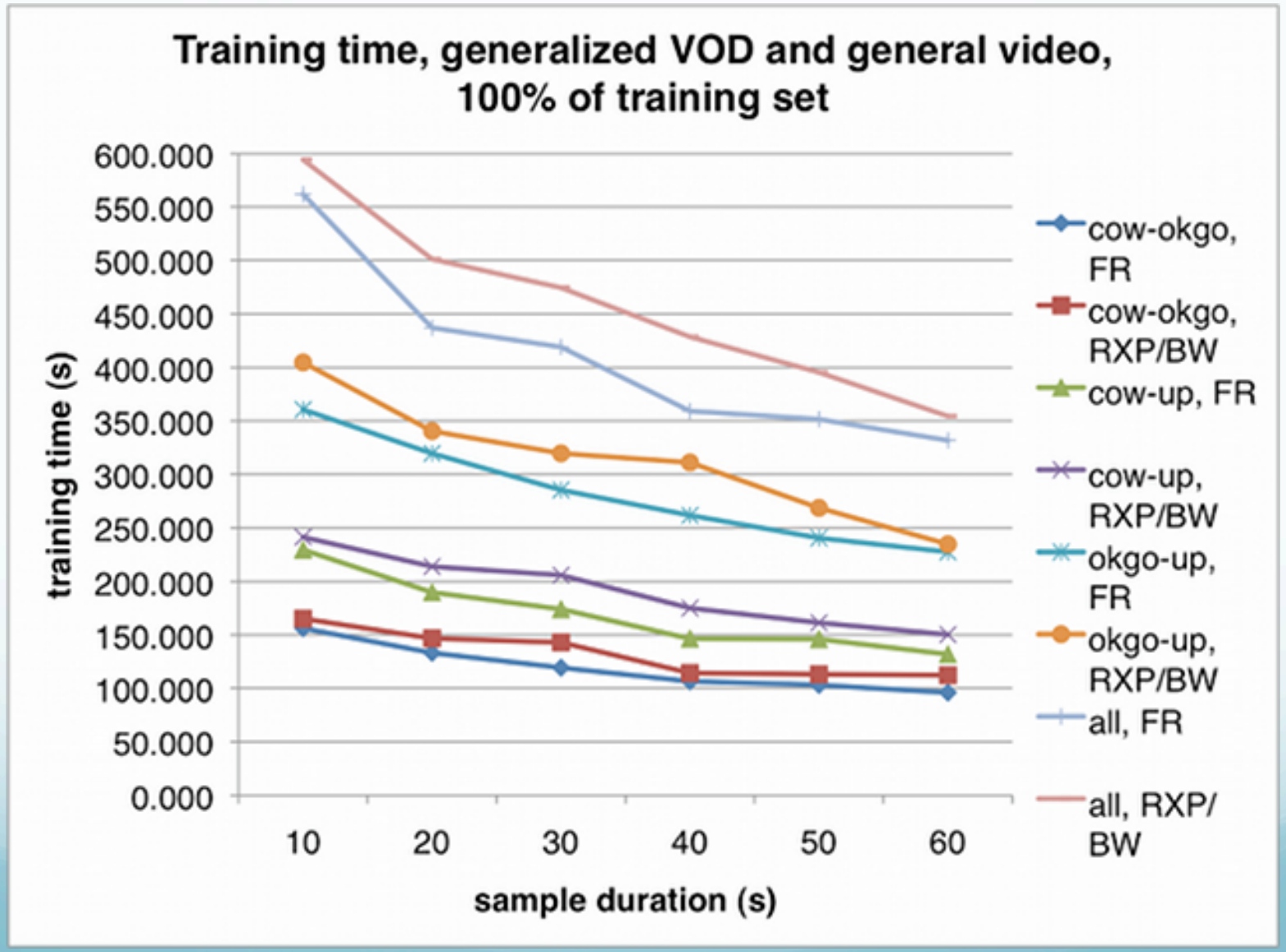
Scenario	Video	Stream state data	Sample rate (s)	Time (s)	Accuracy (%)
Fine-tuned VOD	cow	TP, BW	2	60	82
	okgo	TP, BW	1	20	84
	up	TP, BW	1	20	80
General VOD	cow	FR	5	50	88
	okgo	TP, BW	1	50	86
	up	TP, BW	1	20	81
General video	cow	FR	1	50	83
	okgo	TP, BW	2	20	79
	up	TP, BW	1	50	75

TP = received packets
BW = bandwidth

Results: Top combinations

Scenario	Stream state Data	Sample rate (s)	Time (s)	Accuracy (%)		
				Cow	Okgo	Up
Fine-tuned VOD	Bandwidth + received packets	1	20	77.83	84.10	79.85
General VOD	Bandwidth + received packets	1	20	84.73	83.61	80.60
General video	Bandwidth + received packets	1	20	78.82	78.80	75.19

Timing results, general VOD and general video



Conclusions: Tradeoffs summary

Tradeoff	Best choice	Discussion
Sampling rate	1 sec	Allows maximum detection of congestive events
Interrating time	20 sec	
Stream state data combos	Bandwidth + received packets	(Mostly) stream-independent
Training set composition	All available videos	Fine-tuning does not improve performance here
Training time	< 10 minutes worst case	Off-line; short enough to allow for retraining flexibility

Timing results, fine-tuned VOD