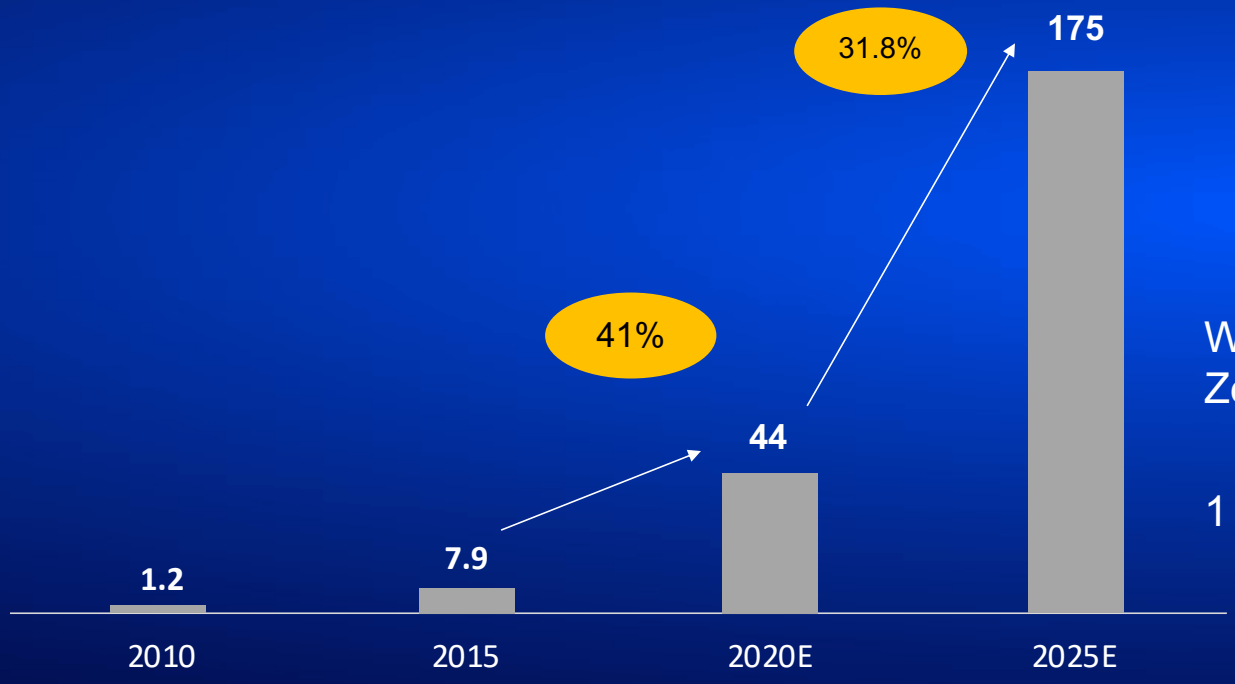
Next Gen Data Storage – Faster, Smarter

Dr. Zining Wu
CEO, Innogrit Corporation

Who is InnoGrit

175 ZB in 5 years



Worldwide data in Zetta bytes (ZB)

1 ZB = 1 billion TB

Source：Gartner, IDC, CB Insights

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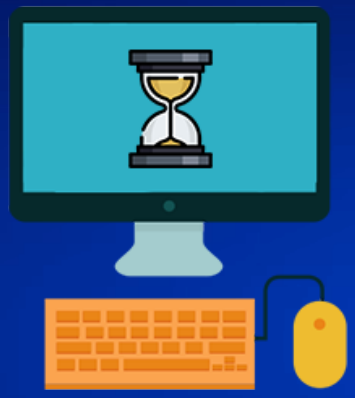

0.5s difference in Page Load Leads to

10% difference in Sales

https://www.bbc.com/news/business-37100091

0.4s delay leads to

0.44% drop in search volume

https://www.thinkwithgoogle.com/marketing-resources/the-google-gospel-of-speed-urs-hoelzle/

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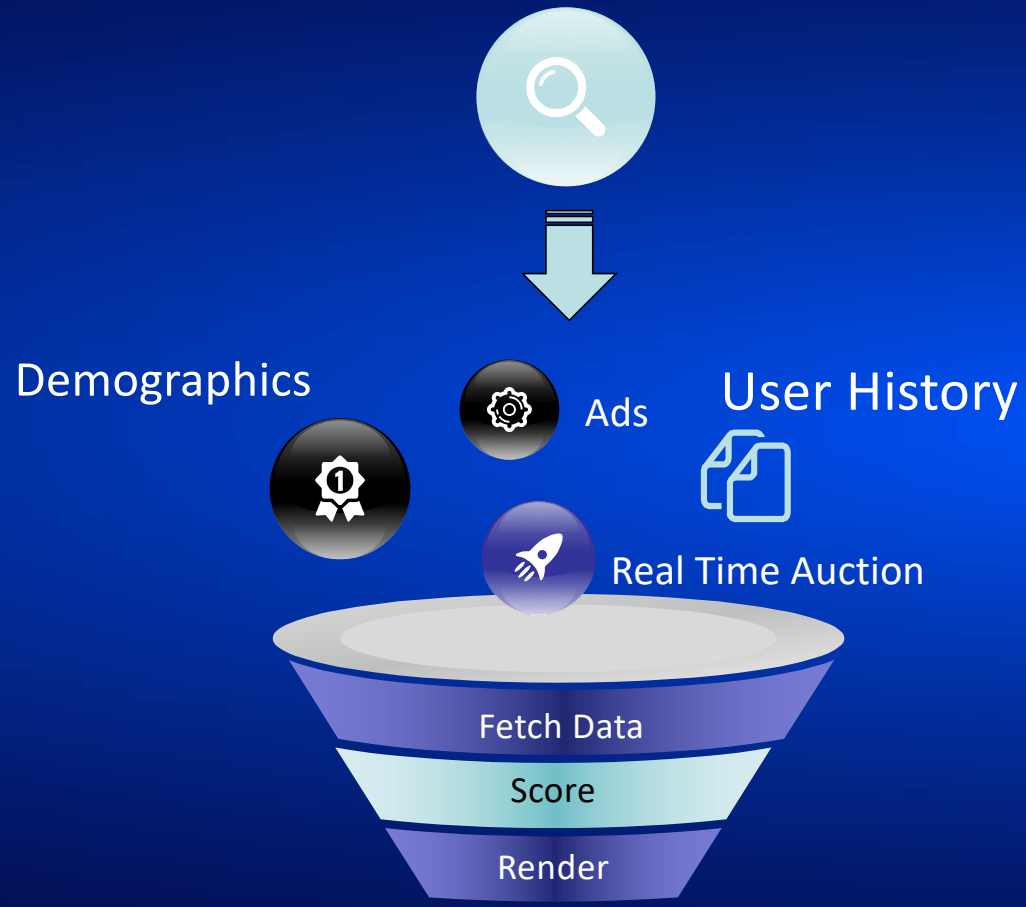
Demographics
Ads
User History
Real Time Auction
Fetch Data
Score
Render

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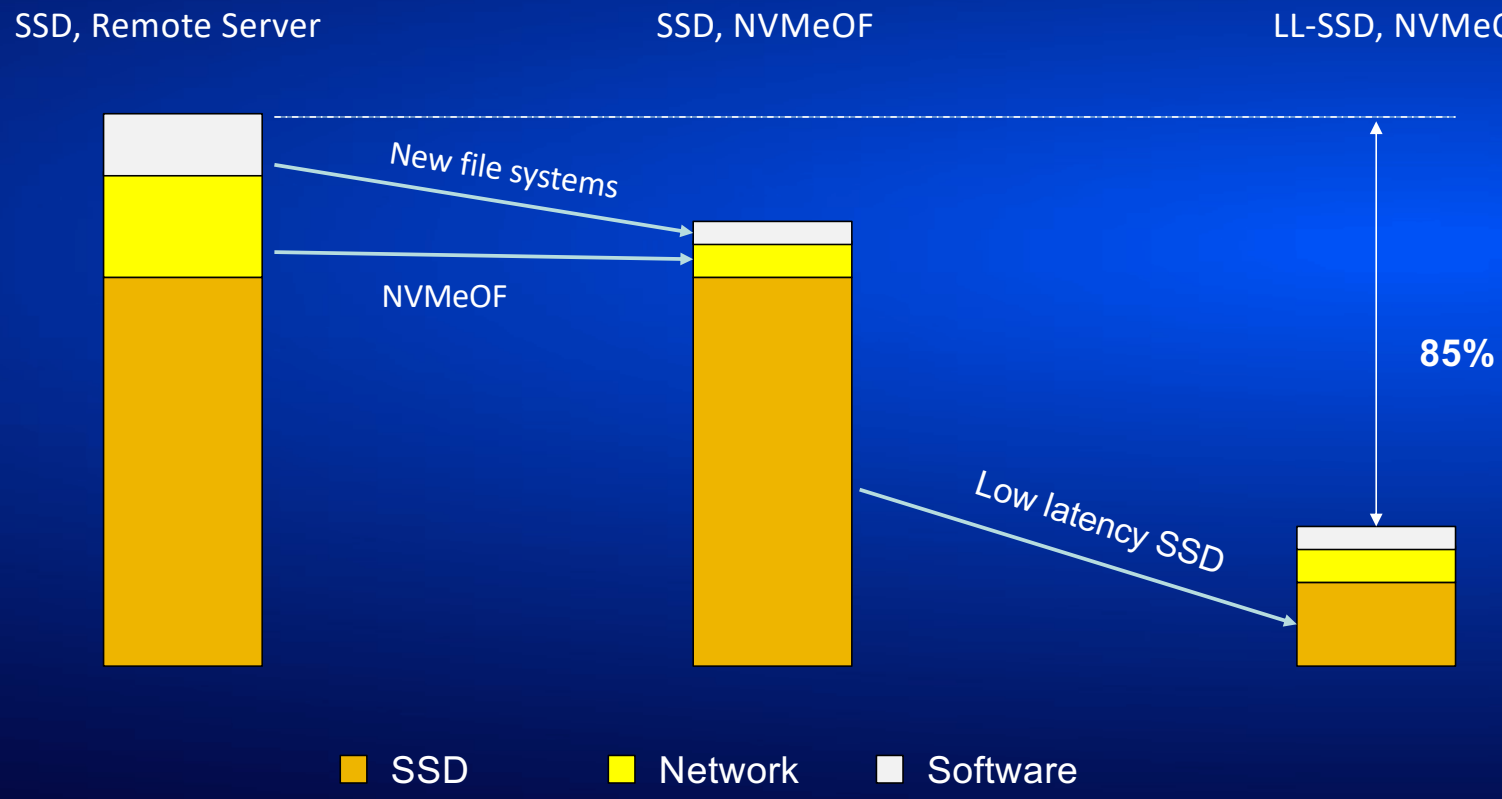
System Optimization Demands Shorter SSD Latency



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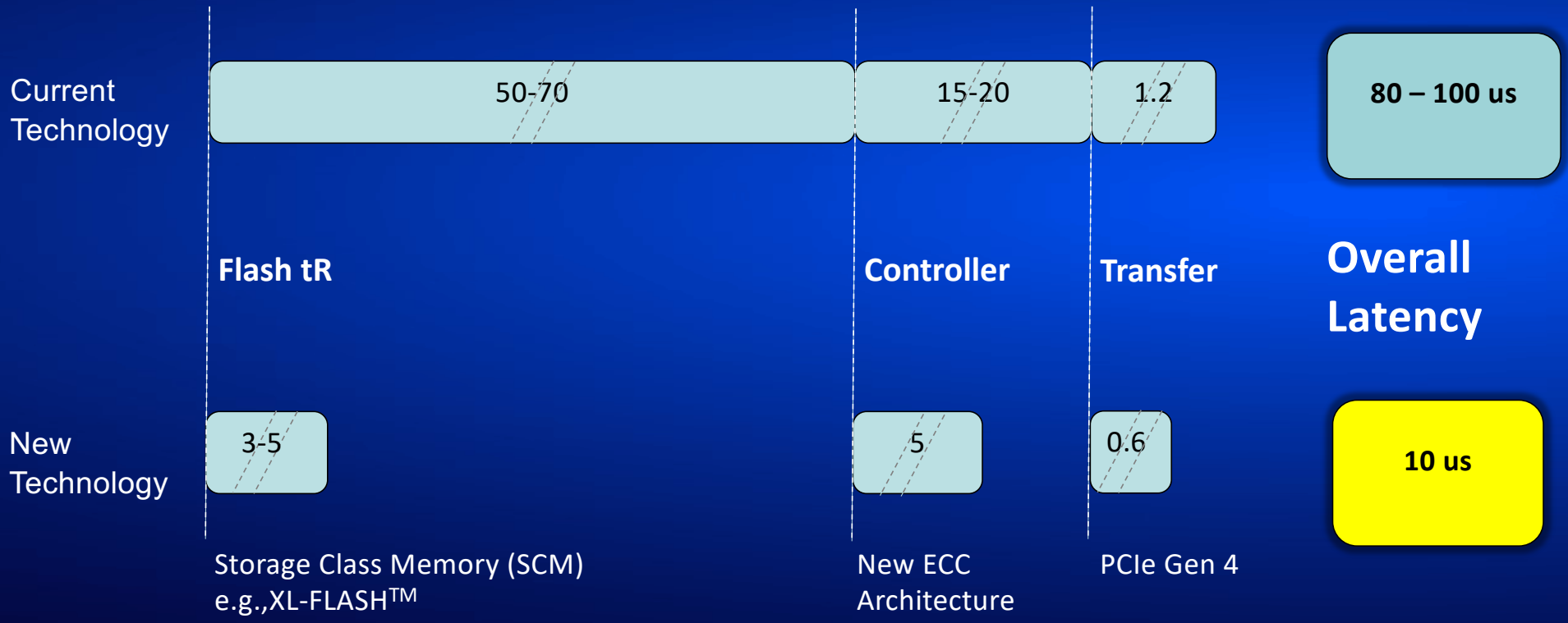
Reduce SSD Latency with Low-latency Flash



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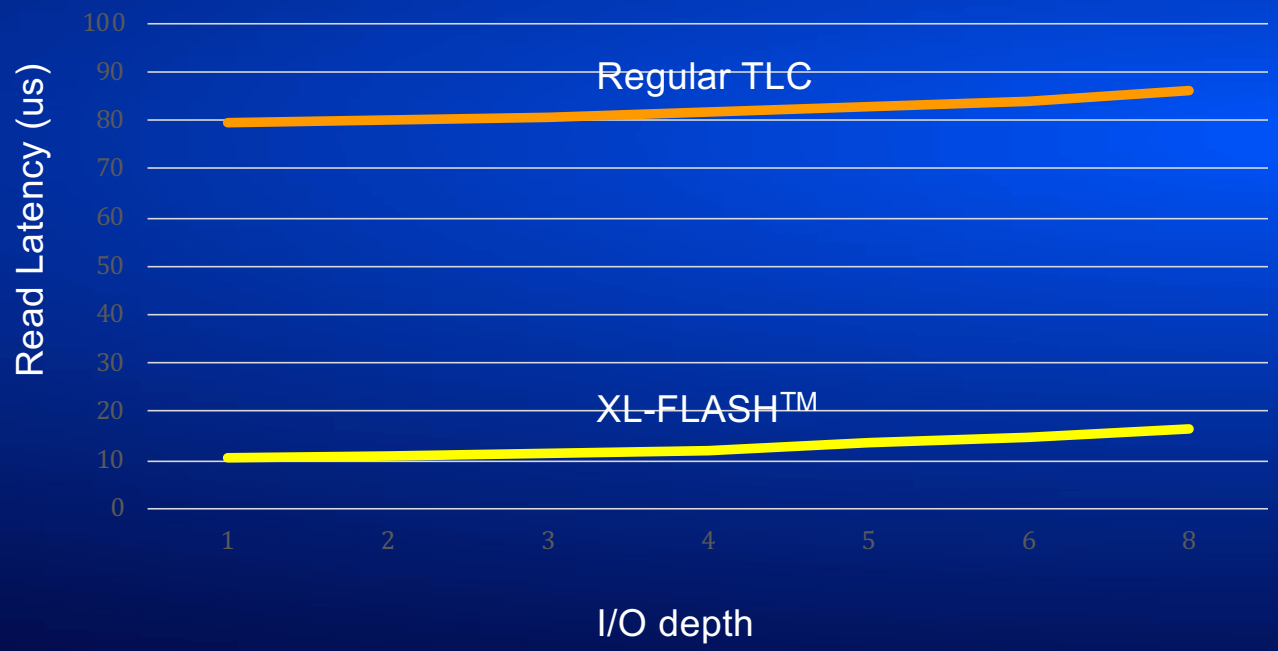
Achieve 10us Latency with Tacoma Controller



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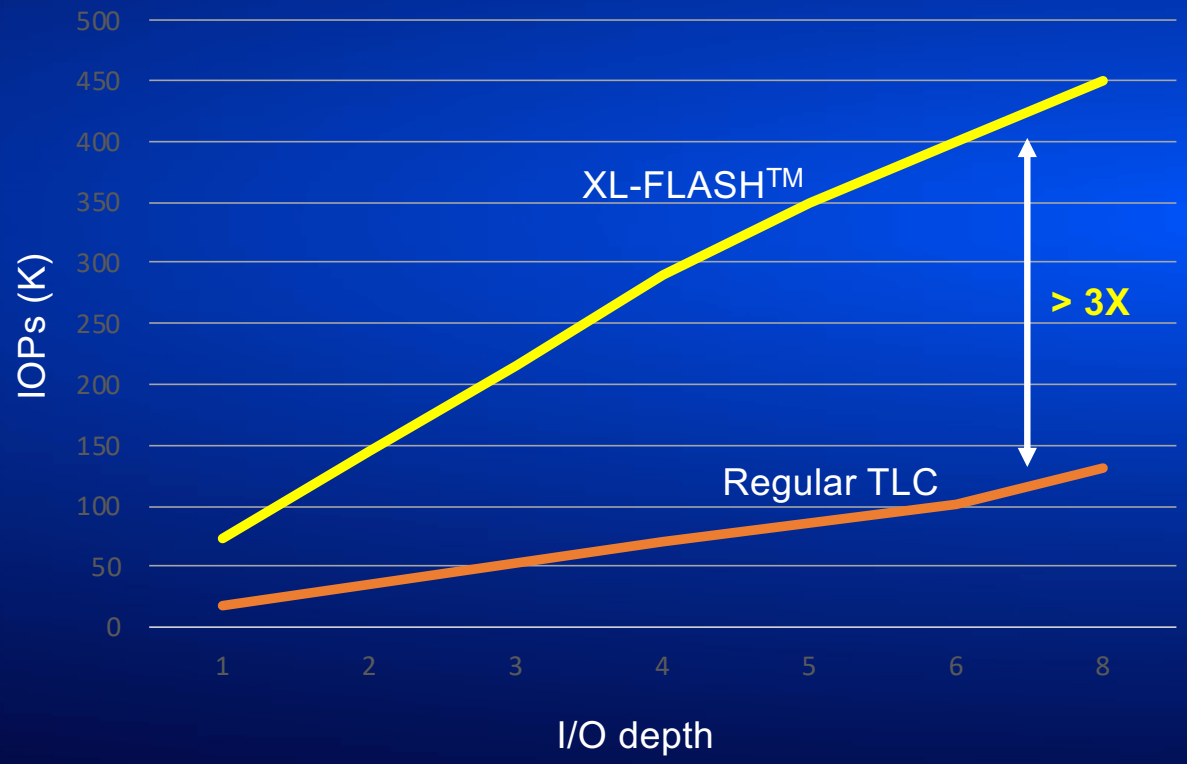
High IOPs at Low Queue Depth with Tacoma



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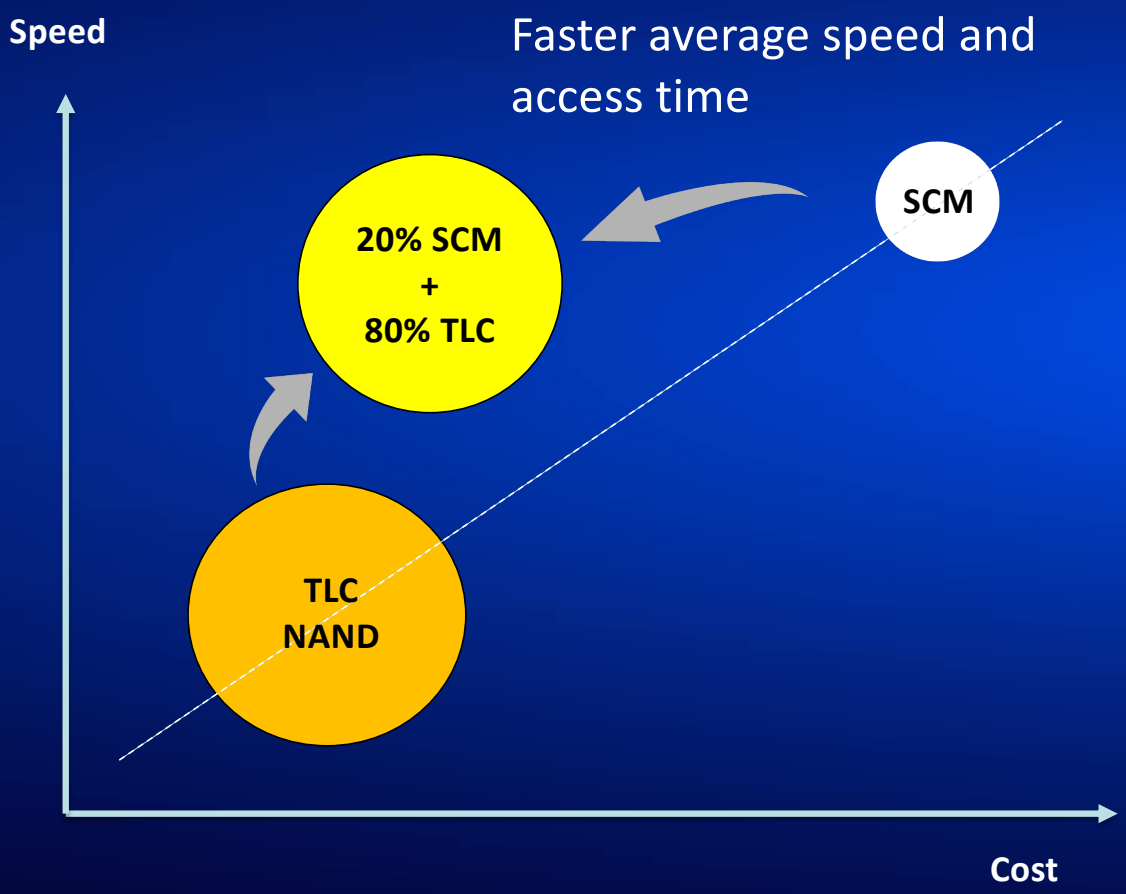
From “Small & Fast” To “Big & Fast”



or

Ideally, hot data in SCM; cold data in TLC

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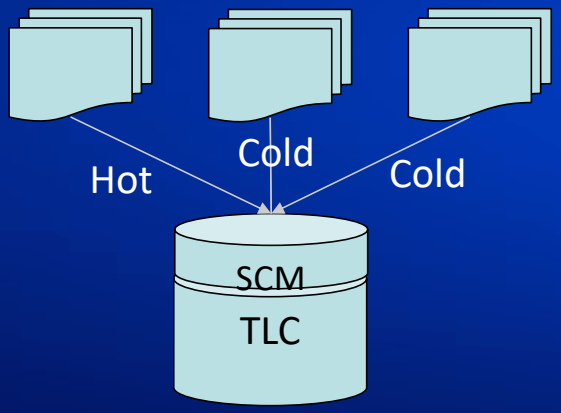
Use Hints from Application



- ✓ accurate
- ✗ contention in a multi-tenant environment
- ✗ Hints may not have temporal information

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Use Neural Networks to Predict Hot/Cold Data

- Self-adaptive
- Considers temporal information

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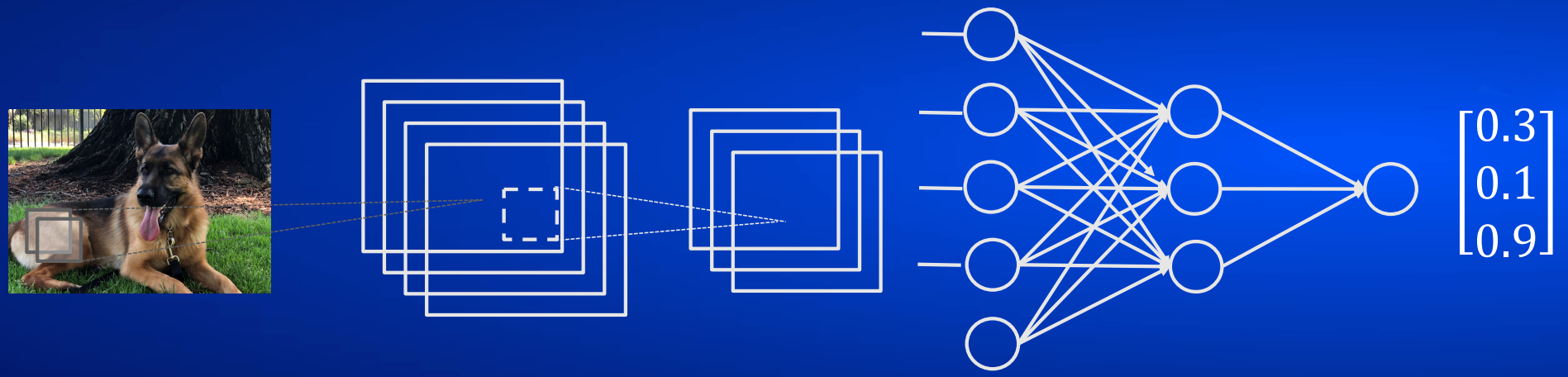
Apply Image Recognition to Data Labeling

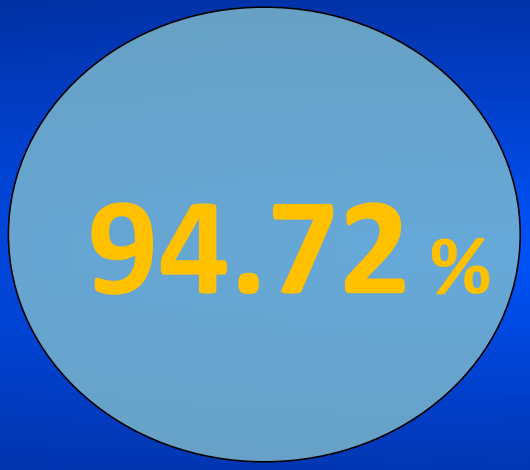


Dog or Cat?

Hot Data or Cold Data?

NN Based Model Predicts Very Well

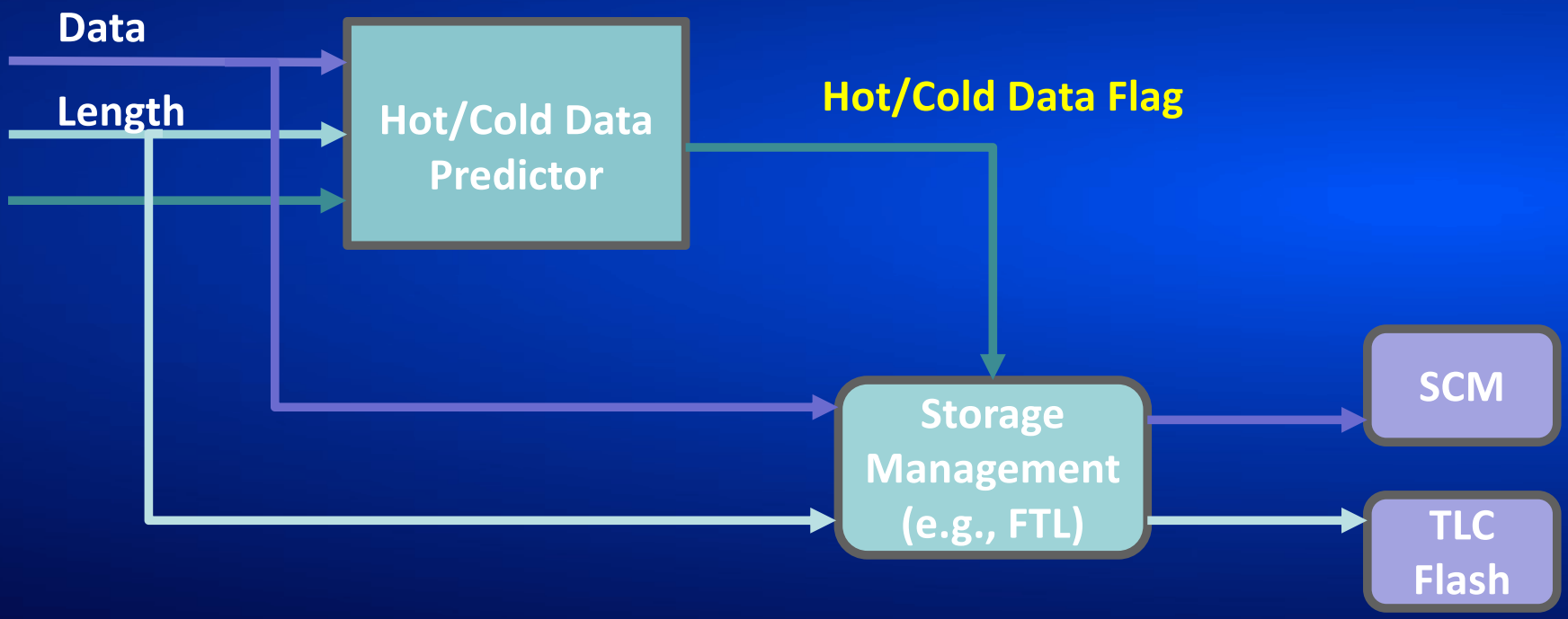
PC User Trace



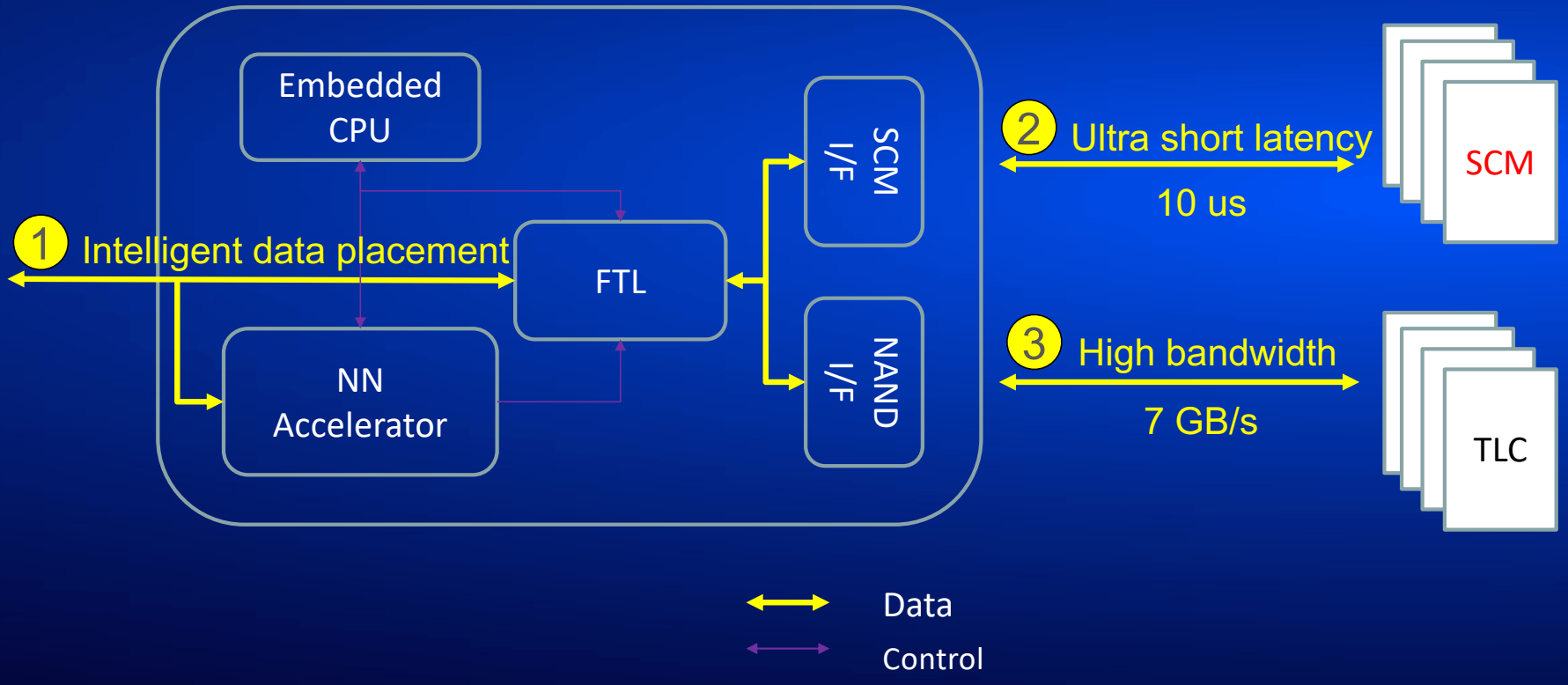
Enterprise Trace
(SPC Financial 1)

Hot/Cold data defined using WDAC method in Park, Dongchul, and David HC Du. "Hot data identification for flash-based storage systems using multiple bloom filters." *2011 IEEE 27th Symposium on Mass Storage Systems and Technologies (MSST)*. IEEE, 2011.

Apply NN in Storage Controller



Tacoma Architecture – Best of Both Worlds



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Tacoma

NVMe 1.4

Atomic Write

Seq Read	7 GB/s
Seq Write	6.1 GB/s
Random Read	1.5M IOPs
Random Write	1M IOPs
Latency w/ XL-FLASH™	10 us

SRIOV

Multiple Name Space

Hardware Crypto Engine

End to End Data Protection

Neural Network

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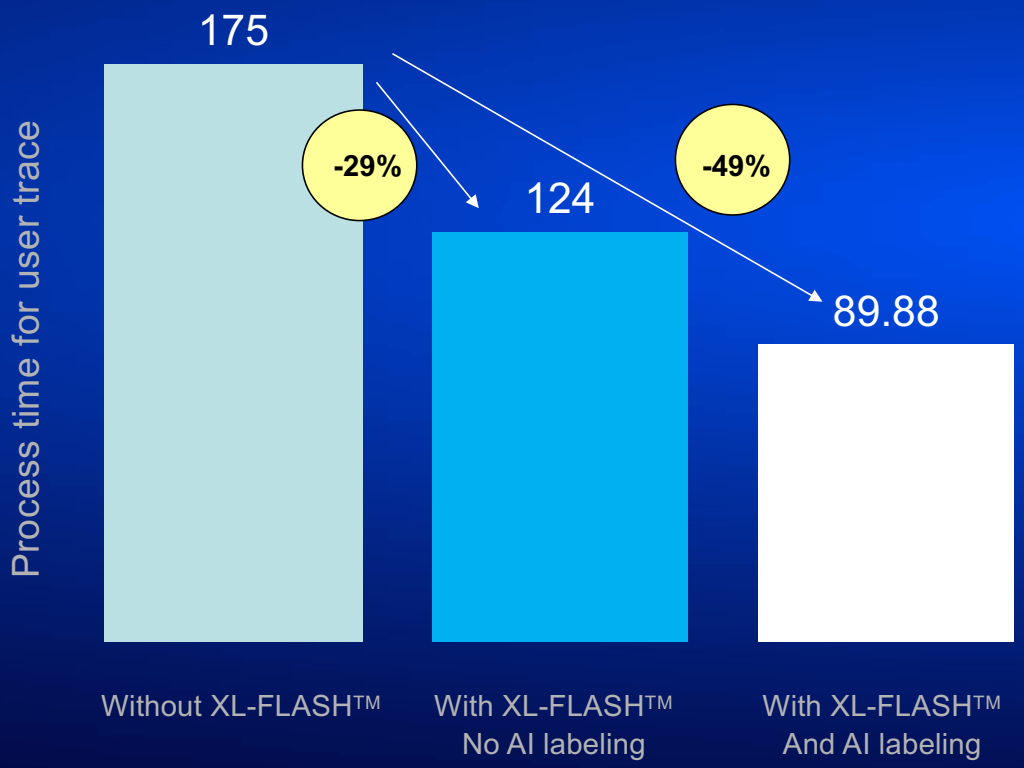
Double the Throughput



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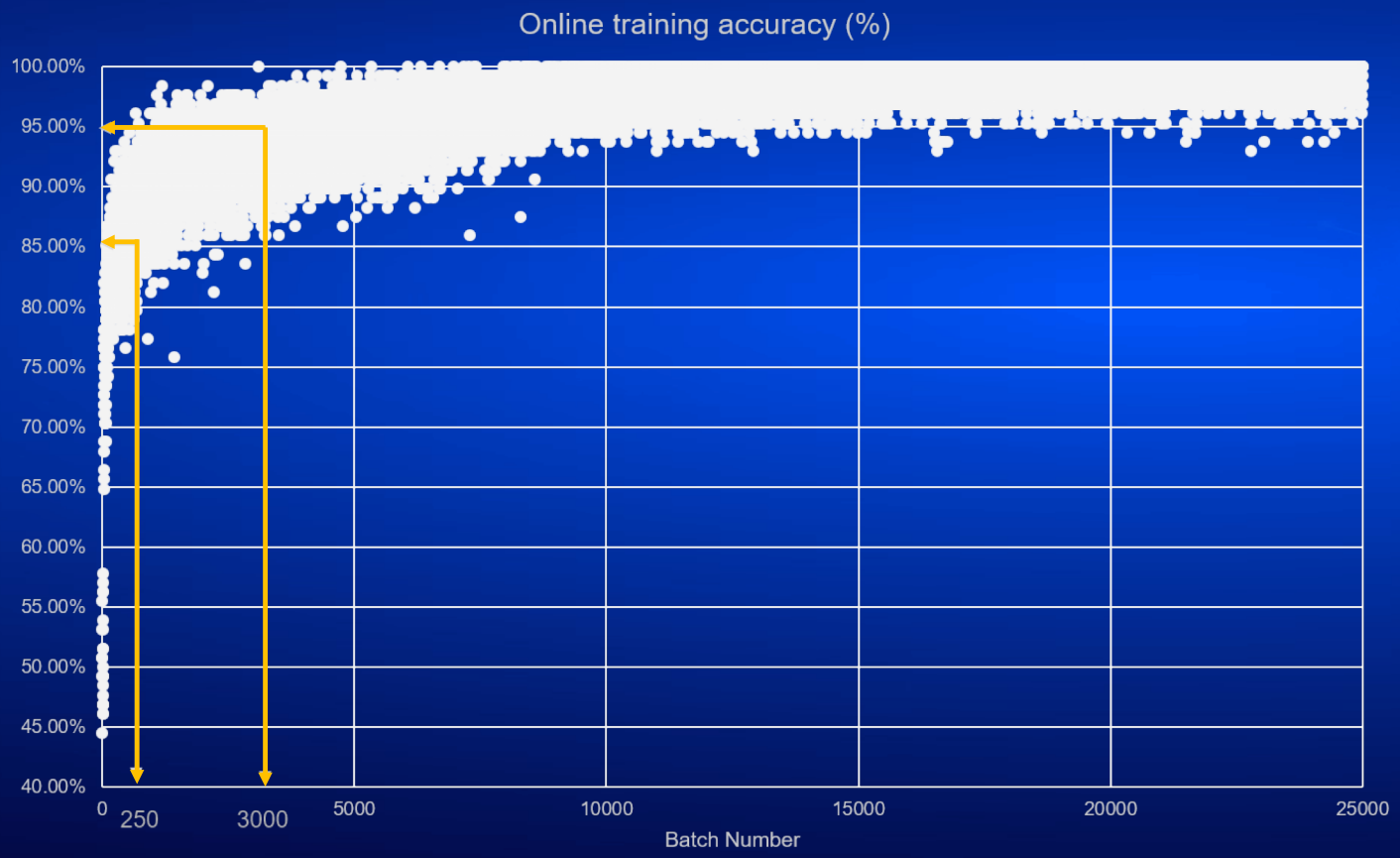
Adaptive and Self-trained

Achieve 85% accuracy at ~250 batches

Achieve 95% accuracy at ~3000 batches



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Faster

Proper Controller

Design and SCM

Smarter

CPU + NN

Architecture

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THANK YOU

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