



Paramount

SKUNK WORKS



INSIDE- **PARAMOUNT** SKUNK WORKS

INNOVATION. SPEED. EXCELLENCE. MISSION SUCCESS.

CESAR MASCARENHAS
CHIEF ARCHITECT

Paramount
SKUNK WORKS

CHENXIN JI
SENIOR DIRECTOR OF
ENGINEERING - APPS

Paramount
SKUNK WORKS

J HAUSMANN
DIRECTOR OF ENGINEERING -
PLAYBACK

Paramount
SKUNK WORKS

TOM SCHULTZ
VICE PRESIDENT
OF ENGINEERING

Paramount
SKUNK WORKS





SKUNK WORKS? ISN'T THAT LOCKHEED - YES!



Founded in 1943 by **Clarence "Kelly" Johnson** to build the XP-80 Shooting Star, the United States' first operational jet fighter, the Skunk Works®—originally Lockheed Advanced Development Projects—was established to create top-secret, high-risk aircraft under accelerated schedules.



MISSION:

To work on innovative and classified projects that are ahead of current technology and defense needs.



INNOVATIONS:

- Developed iconic aircraft, including the U-2 spy plane, the SR-71 Blackbird, the F-117 Nighthawk stealth fighter, the F-22 Raptor, and the F-35 Lightning II.



KELLY'S 14 SKUNK WORKS RULES:

Leadership Principles that Matter



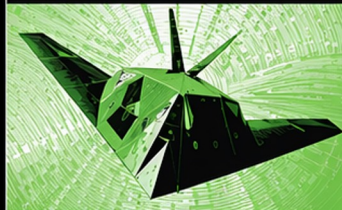
MANAGEMENT STYLE:

Johnson created a unique, anti-bureaucratic management style that relied on small, empowered teams, rapid prototyping, and a culture of risk-taking.

THE CLASSIC ACCOUNT OF
THE LEGENDARY SKUNK WORKS

MORE THAN 300,000 COPIES SOLD

SKUNK WORKS



"Dynamite—the true story of one of America's crown jewels."
—TOM CLANCY

"A gripping technothriller in which the technology is real."
—NEW YORK TIMES

BEN R. RICH and **LEO JANOS**

Recommended Reading:

Skunk Works

by Ben R. Rich and Leo Janos



KELLY JOHNSON'S LEGACY LIVES ON

The Skunk Works® mindset continues to push the boundaries of what's possible.

INNOVATE | ADAPT | EXCEL | DELIVER THE IMPOSSIBLE














Kelly Johnson

1910–1990



PARAMOUNT **SKUNK WORKS** MISSION

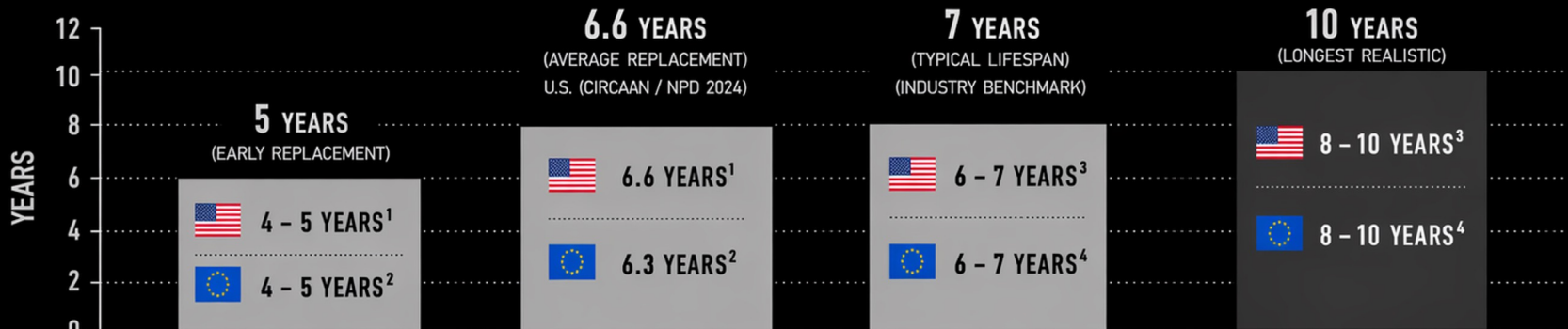


	TO SOLVE THE MOST DIFFICULT STREAMING PROBLEM - SPEED
	STEALTH MODE, LIMITED AUDIENCE / INVITE ONLY, NEED TO KNOW
	NO LABELS: PARAMOUNT+ OR PLUTO TV ENGINEERS. WE ARE ALL SKUNKS 
	KPI, BENCHMARK DRIVEN TTFF, VST, VSF, SPI, REBUFFER RATE, TTFR
	RISK TAKING, EXPERIMENTAL, INCUBATED
	TECH STRATEGY - DEVICE CAPABILITIES UP
	RIGHT TOOL, RIGHT JOB - AI ASSISTED
	CRITICAL PATH = POC TO MVP
  	LIVE SPORTS PROVING GROUNDS
	SHIP AHEAD OF SCHEDULE



HOW LONG DO PEOPLE KEEP THEIR SMART TVs?

Real-world replacement cycle vs. potential lifespan and typical hardware / feature profile



	EARLY REPLACEMENT (~5 Years)	AVERAGE REPLACEMENT (~6.6 Years)	TYPICAL LIFESPAN (~7 Years)	LONGEST REALISTIC (~10 Years)
AVG CPU	QUAD-CORE ~1.2 GHz	QUAD-CORE ~1.5 - 1.8 GHz	QUAD-CORE ~1.8 - 2.2 GHz	QUAD-CORE ~2.2 - 2.6 GHz
AVG GPU	MALI-450 / 550 MP2 ~150 GFLOPS	MALI-652 MP2 / G52 MP3 ~250 - 300 GFLOPS	MALI-652 MP4 / G57 ~350 - 500 GFLOPS	MALI-652 / G78 ~600 - 900 GFLOPS
MEMORY	1 - 1.5 GB RAM	2 - 3 GB RAM	3 - 4 GB RAM	4 - 6 GB RAM
HTML5 APP MEMORY <small>(Per App / Window)</small>	~300 - 500 MB usable per app	~500 - 800 MB usable per app	~800 MB - 1.2 GB usable per app	~1.2 - 2 GB usable per app
HDR SUPPORT	HDR10	HDR10 / HLG	HDR10 / HLG / HDR10+	HDR10 / HLG / HDR10+ / DOLBY VISION

Note: Specifications are industry averages for smart TVs in each age segment. Actual specs vary by brand and model.



HOW LONG DO PEOPLE KEEP THEIR SET TOP BOXES AND GAMING COISOLES?

Real-world replacement cycle vs. potential lifespan and typical hardware / feature profile

SET-TOP BOXES

(Typical Lifespan: ~3 – 5 Years)



GAMING CONSOLES

(Typical Lifespan: ~6 – 7 Years)



	SET-TOP BOXES	GAMING CONSOLES
AVG CPU	QUAD-CORE ~1.5 – 1.8 GHz	8-CORE (ZEN 2 / CUSTOM) ~3.0 – 3.5 GHz
AVG GPU	MALI-G52 MP2 / MP3 ~250 – 350 GFLOPS	RDNA 2 / RDNA 3 (CUSTOM) ~10 – 16 TFLOPS
MEMORY	2 – 4 GB RAM	16 – 20 GB GDDR6
HTML5 APP MEMORY <small>(Per App / Web Runtime)</small>	~300 – 500 MB usable per app	~1.0 – 2.0 GB usable per app
HDR SUPPORT	HDR10 / HLG	HDR10 / HLG / HDR10+ / DOLBY VISION



OUR INNOVATIONS

HIGH PERFORMANCE. MODULAR. BUILT FOR THE FUTURE.



BLACKBIRD PLAYBACK SDK

Code name after the SR-71.
Built for speed. Engineered
for altitude.



BLACKBIRD **PLAYBACK SDK**

Our core playback engine. Ultra-low latency,
high efficiency, and built to scale.

CAPABILITIES

- 🔒 Multi-DRM & Format Support
- 📶 ABR / Low Latency
- 📄 Ad Insertion (Server & Client)
- 🎞️ Trick Play & Chaptering
- 📶 Analytics & Telemetry Hooks
- 🌐 Cross-Platform (TV, Web)



RAPTOR **CAPABILITIES COMPONENT**

Code name after the F-22.
A modular set of next-gen capabilities
that integrate with Blackbird, Lite, Amazon Vega.

CAPABILITIES

- 🧠 AI/ML Enhancements
- 📄 Advanced Ad Experiences
- 👤 Personalization & Recommendations
- 📊 Advanced Analytics



LITE **(APP)**

Lightweight. Fast to deploy.
Everything you need to launch,
nothing you don't.

Runs on any Smart TV, Set Top Box, or Gaming Console.



SMART TV



SET TOP BOX



GAMING CONSOLE

IDEAL FOR

- 🚀 FAST Channels
- 🌐 Emerging Markets
- 💰 Cost-Conscious Deployments
- 🕒 Rapid Time to Market



AMAZON VEGA **(APP)**

Premium Experience.

Designed to delight. Built to scale.

EXPERIENCE

- ⭐ Premium UI / UX
- 🏠 Personalized Home
- 🔍 Rich Content Discovery
- 🛡️ Enterprise-Grade Security



LITE AND VEGA ARE BUILT ON THE SAME PROPRIETARY ARCHITECTURE
PATENT PENDING

INNOVATION. SPEED. EXCELLENCE. MISSION SUCCESS. ★ PARAMOUNT SKUNK WORKS ★



PROVING GROUNDS

FIRST TO PROVE. NOT FIRST TO IDEATE.

SKUNK WORKS

The Skunk Works Proving Grounds establishes a real-world, execution-driven model for rapidly validating and scaling playback innovation by applying a "first to test" aerospace mindset—where advantage is gained not by being first to ideate, but first to prove under real conditions.

PROVING GROUNDS LOCATION

Held on-site in Burbank— serving as a centralized proving ground, much like Groom Lake did for Lockheed's original Skunk Works.



PROVING EVENTS



THE MASTERS

Multi-feed, global complexity across Paramount+ and partners

UFC 327

Peak concurrency, premium live event exclusively on Paramount+.



REAL-WORLD EXECUTION

APRIL 6–11, 2026

Global, real-time execution across Skunk Works teams all around the world — including our Center of Excellence (COE) in Europe.



LIVE SPORTS PROVING GROUNDS
SHIP AHEAD OF SCHEDULE



PROVING GROUNDS - RESULTS

REAL-WORLD PERFORMANCE COMPARISONS UNDER LIVE CONDITIONS

RESULT 1

LITE APP PERFORMANCE

LITE APP (SKUNK WORKS) vs IN MARKET PARAMOUNT+ SAMSUNG TIZEN 2017 APP



RESULT 2

VEGA APP COMPARISON

IN MARKET VEGA APP vs NEW SKUNK WORKS APP

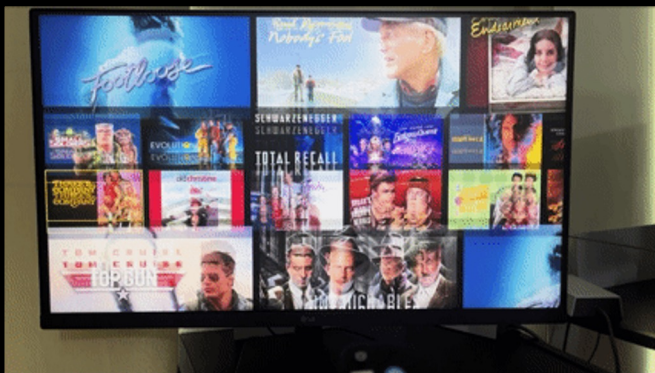




TAKING ACTION



We split the team: one path dug deep into the existing codebase; the other prototyped a faster way to build and scale.





WHAT TIPPED THE DECISION



Vega tooling surfaces what the GPU draws (overdraw) and how the app runs — so we could tune rendering and chase performance with the same platform-native workflows.

<https://developer.amazon.com/docs/vega/0.22/debug-apps-overview.html>





WHAT TIPPED THE DECISION




Home

Pluto TV - Watch Free Movies, Shows & Live TV

Press  to Manage this app

Pluto TV is the leading free streaming television service to watch blockbuste...

Recently used apps

- 
- 
- 
- 
- 

Recommended free movies and TV shows

- 
- 
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- 
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- 

prime Fantasy TV

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Three Components. Every Screen.

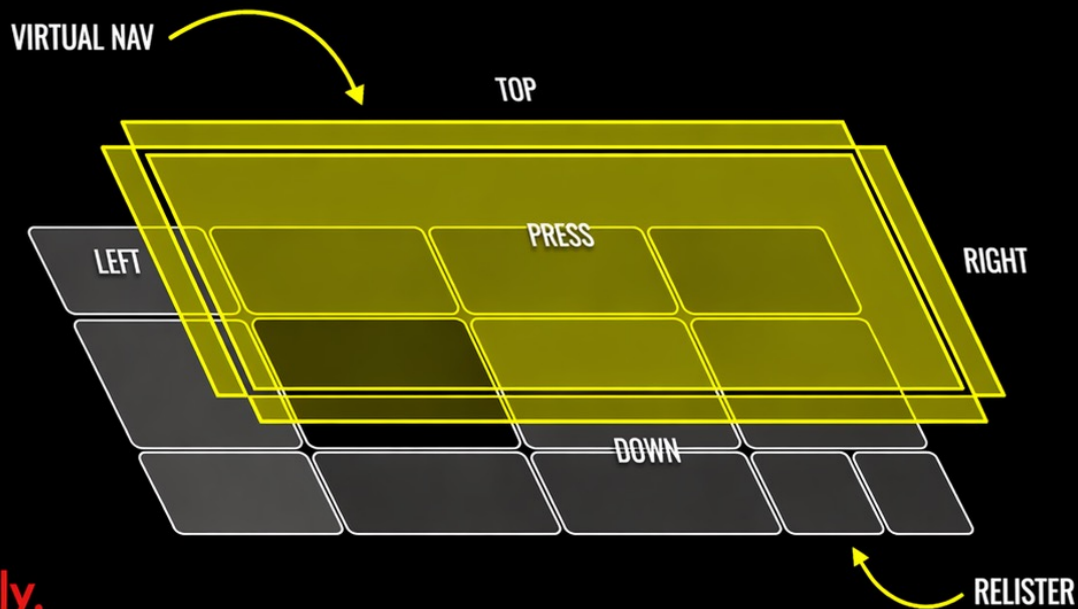


Composable layers

We didn't build a grid.

We built a focus primitive, then a list that uses it, then a grid that composes two lists.

Each layer ships independently.





VIRTUAL NAVIGATION

Virtual DOM: don't touch the real DOM, work with a virtual representation.

Virtual Scrolling: don't render 1,000 items, render 10 and recycle.

Virtual Focus: don't make 200 tiles focusable. Make one.



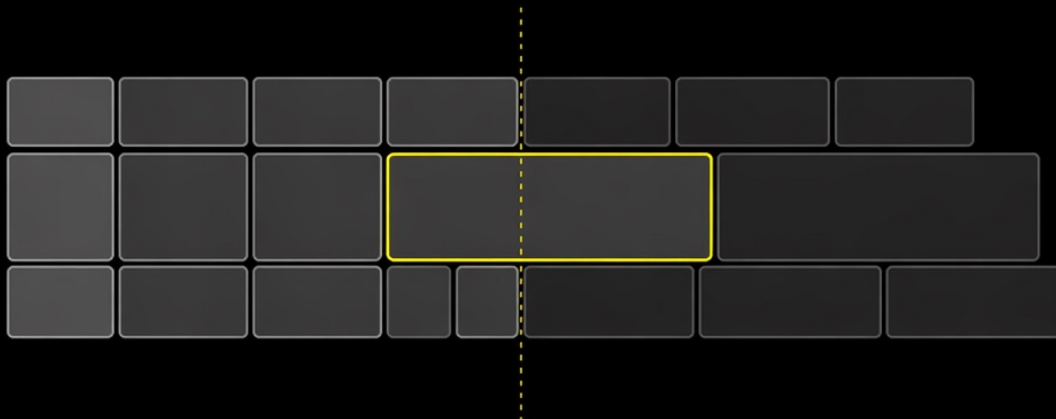
VIRTUAL NAVIGATION



Minimal work per navigation

Decoupled from render lifecycle

Built-in accessibility support





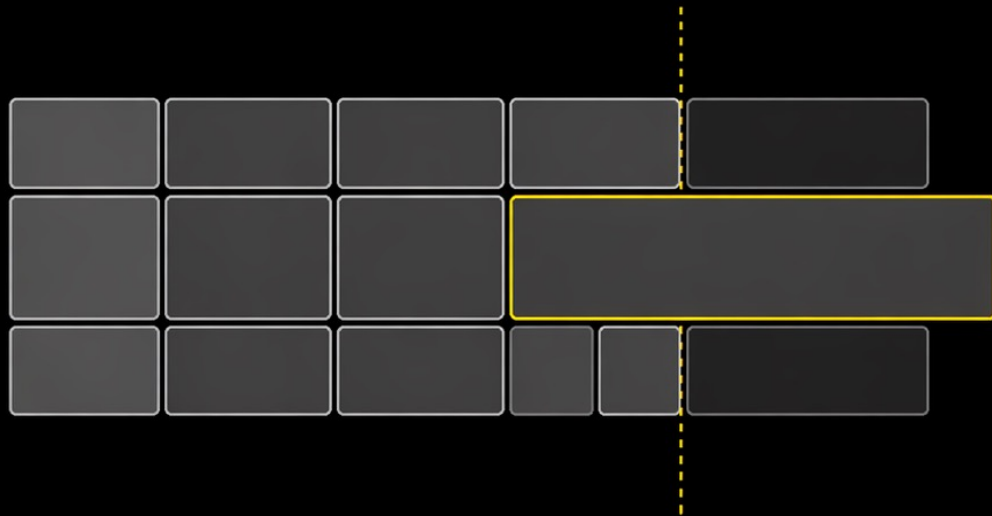
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VIRTUAL NAVIGATION



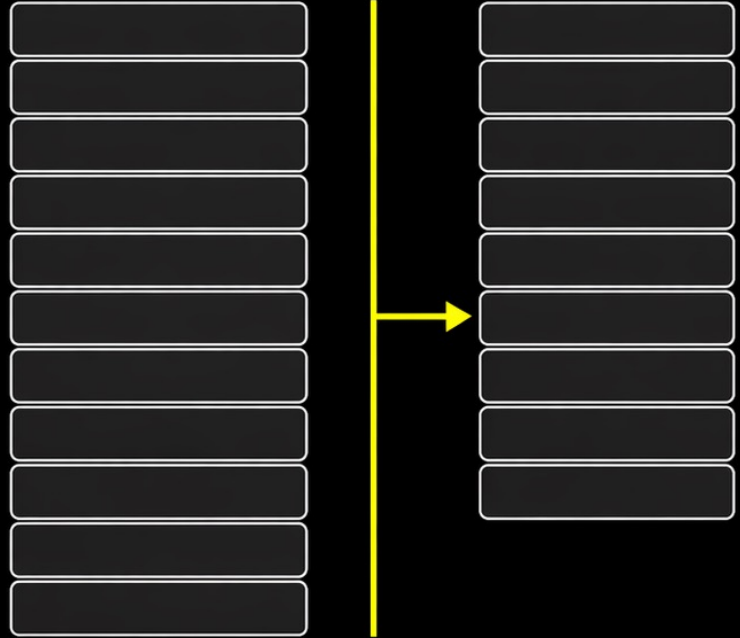
Navigation became predictable —
not something we had to fight.



RELIST



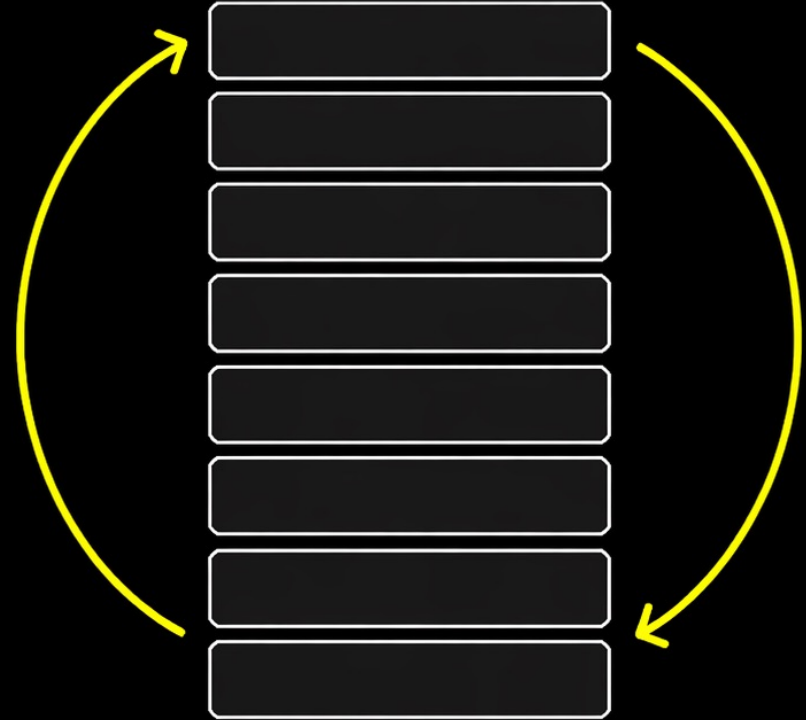
- No dependency on list libraries
- Deterministic layout —
no runtime measurement
- Single source of truth for interactions
- **Features are a single prop away.**





RELIST

- No dependency on list libraries
- Deterministic layout —
no runtime measurement
- Single source of truth for interactions
- **Features are a single prop away.**





RELIST



**We could scale content without
sacrificing performance.**

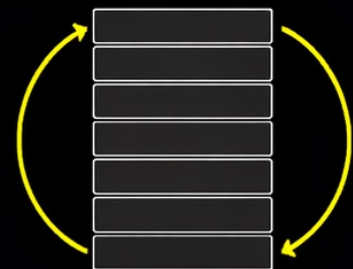
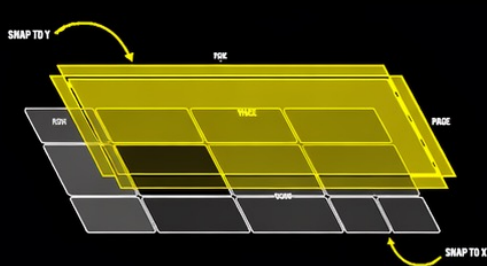


RelistGrid

One renderItem.

Everything else is configuration:

- **snapToX / snapToY**
Scroll snapping behavior
- **trapDirections**
Prevent focus escape at edges
- **isolateRowFocus**
Remember column per row
- **directions**
Connect to external components
- **focusMargin**
Account for overlapping nav



	1	2	3	
	4	5	6	
	7	8	9	
	10	11	12	13
	14	15	16	



Before, and After.



Production

The screenshot shows the production interface for the TV show 'U.S. Marshals'. The background is a large image of Kayce Dutton on a horse. On the left, there is a vertical navigation menu with icons for search, home, list, settings, and a plus sign. The main content area features the show's title 'MARSHALS' with a logo, followed by the text 'NEW EPISODE NOW STREAMING' and a short synopsis: 'With the Yellowstone Ranch sold, Kayce Dutton brings his skills as a cowboy and Navy SEAL to the U.S. Marshals.' Below this is a blue 'WATCH NOW' button. At the bottom, there is a 'Your Next Watch' section with a row of eight small episode thumbnails, each with a 'NEW EPISODE' label.

In Development

The screenshot shows the development interface for the TV show 'U.S. Marshals'. The background is a large image of a horse. At the top, the show's title 'MARSHALS' is displayed with a logo. Below it, the text 'NEW EPISODE NOW STREAMING' is shown, followed by a synopsis: 'With the Yellowstone Ranch sold, Kayce Dutton brings his skills as a cowboy and Navy SEAL to the U.S. Marshals.' A blue 'WATCH NOW' button is positioned below the synopsis. Further down, there is a 'Your Next Watch' section with a row of eight episode thumbnails, each labeled 'NEW EPISODE'. Below this row, the text 'Keep Watching' is visible.



Before, and After.



Metric	Production	In development	% better
Full Keep Watching row	32 s	18 s	~44%
First row → last row	32 s	10 s	~69%
Home load	8 s	4 s	50%
State between screens	Reload each visit	Memory retained	—
Z-index & drop- shadow (columns)	No	Yes	—



Patterns to Take With You



Pattern	What it is	Why it matters
Virtual focus	One focus node, logical index — not N focusable tiles	Same idea on any TV stack; predictable D-pad at scale
Controlled focus	Focus as a prop, not useState in every tile	Pure presentational tiles; fewer bugs, less churn on navigation
Composable layers	Primitives that stack — not one mega-component	Each piece pulls double duty; reuse across screens
Platform vs. product	Ask: “Is this reusable?” every time	Foundation (TV) vs. brand (Pluto / P+) — ship twice without duplicating the hard parts

Core stack depends only on public Vega APIs documented for app developers developer.amazon.com/docs/vega



THANK YOU!