SOFTWARE DEFINED VEHICLE (SDV) & THE AUTOMOTIVE TRANSFORMATION

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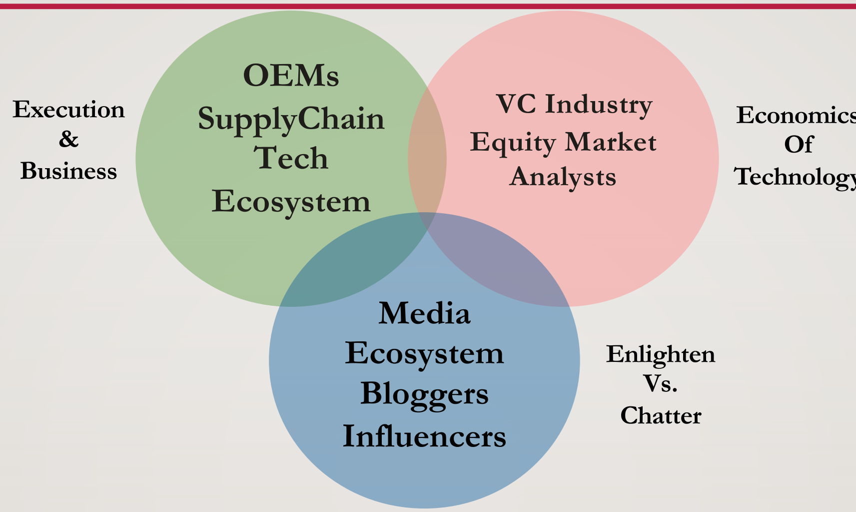
OCTOBER 12, 2023

TOPICS

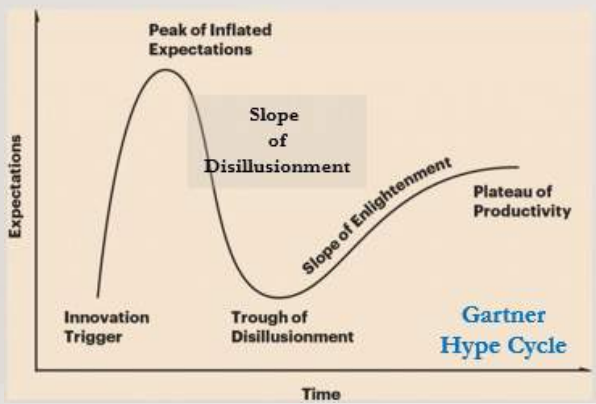
- Change & Perception of Change
  - Emergence of SDV
- Key Drivers & Roadblocks
- Impacts of the transformation
- SDV & Data
- Takeaway

CHANGE & PERCEPTION/ANTICIPATION/CHATTER

Stakeholders Of Change



Stages of Technology Development



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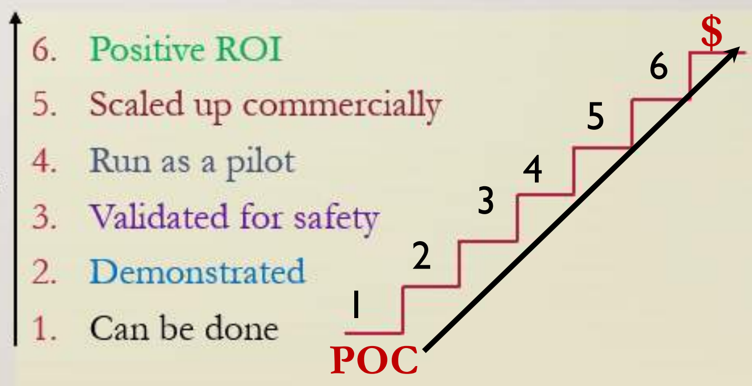
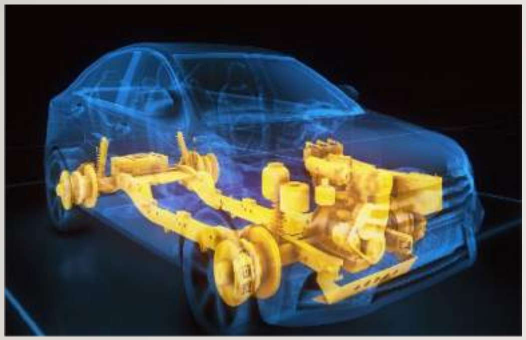


AUTOMOTIVE TRANSFORMATION



2000: One off device

2010: Smartphone on Wheels

2020+: Living Space on Wheels

Vehicle As A Platform

Frequent Refresh & New Capability

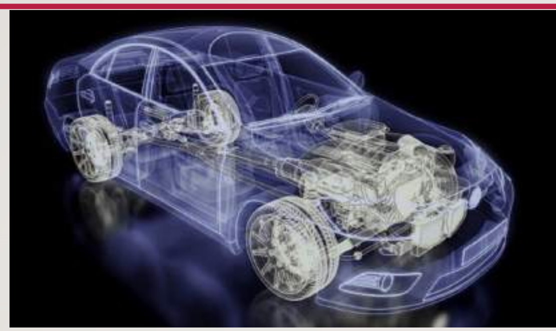
Consumers

Control & Flexibility

OEMs

EMERGENCE OF SDV OR SOFTWARE-DEFINED VEHICLE

2010-2020



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C Connected
A Autonomous
S Services
E Electrified

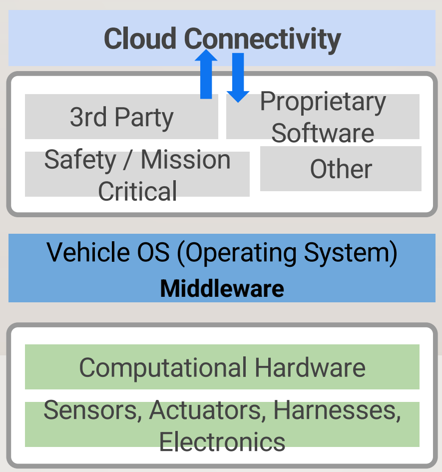
"Clean Sheet" Effect

OTA – Over the air Update

SOA – Service oriented architecture

Post 2020

Software Defined Vehicle (SDV)



KEY DRIVERS

Growth of CASE

Dedicated ECU's → Not Scalable

Processing Power

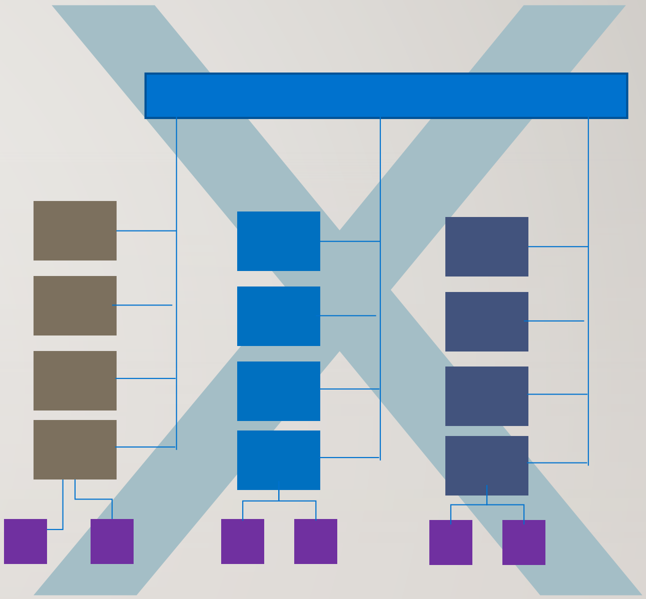
- Can not support the steady growth of complex computation

Communication

- Not designed for low latency communication

De-couple HW & SW

- Not open to expansion



<u>Current Architecture</u>

"Kitchen Sink Approach"

IS ELECTRIFICATION A CATALYST?

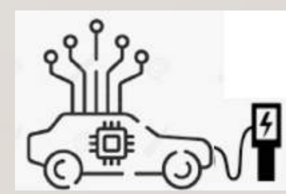
New EV Startups

- Rooted in the software industry & SOA framework

Traditional OEMs

- EVs offer
  - New modular physical architecture
  - Fewer legacy constraints of ICE vehicles
  - Natural scalability of the platform

- EVs happen to be the first adopters of SDV Architecture



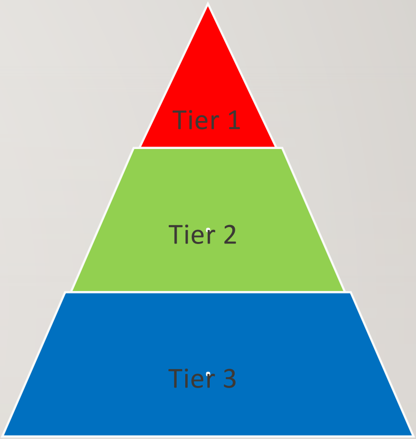
EV: Electric Vehicle
ICE: Internal Combustion Engine
SOA: Service Oriented Architecture

ROADBLOCKS TO SDV - SUPPLY CHAIN

- **Over-optimized components** - from different suppliers, as black box tailored for specific task

- **Not transferrable** between sub-systems or programs

- **Not Reusable** - Variation in suppliers' programming language or dependence on specific hardware



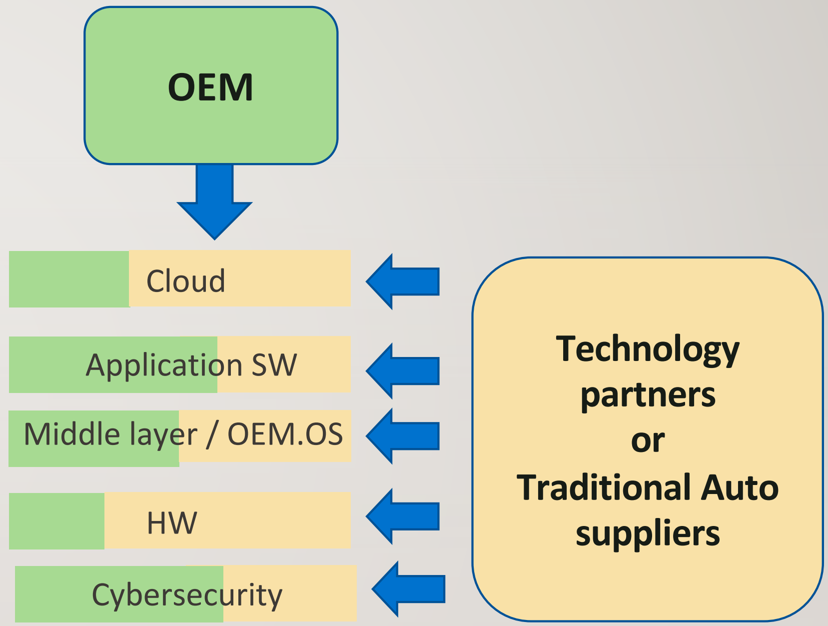
Tiered Supply Chain
Tier 1 often is the Integrator

DIRECT CONTROL & CONTINUOUS DEVELOPMENT

- **Integration** - More direct role
- **Agile** product development
- New Skills – software development

- Design own hardware
- Build their own chip
- In-house development & owning software
- Partnerships

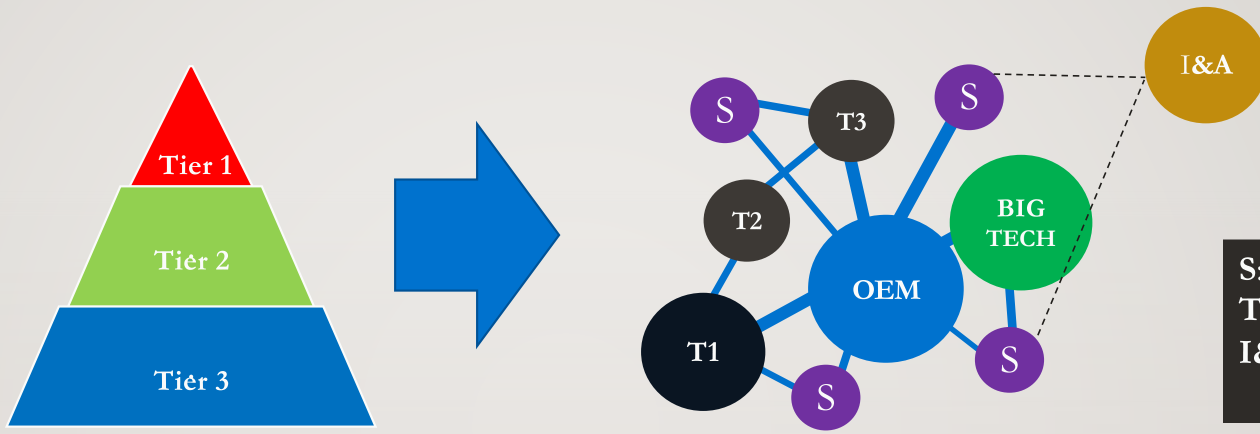
- **Move to More Vertical Integration**



A Generic Scenario – For Illustration Only

EMERGENCE OF A NEW VALUE CHAIN

Shift from Pyramid to Network



S: Startup
T1,2,3: Tier 1,2 or 3
I&A: Incubators & Accelerators

- **OEMs** taking a bigger role & building new skills
- **Tiered suppliers:** Re-skilling for the digital age
- **Startups** interacting closely with the OEMs
- **Technology industry**: Engaging directly with auto industry

HORIZONTAL TO VERTICAL INTEGRATION

Horizontal
to
Vertical Integration

Vertical Integration
Less Reliance on Tier1's

- Traditional supply chain
- Tier1: system integrator
- Kitchen-sink approach

- Close gaps in HW/SW Competence
- Develop agile product development

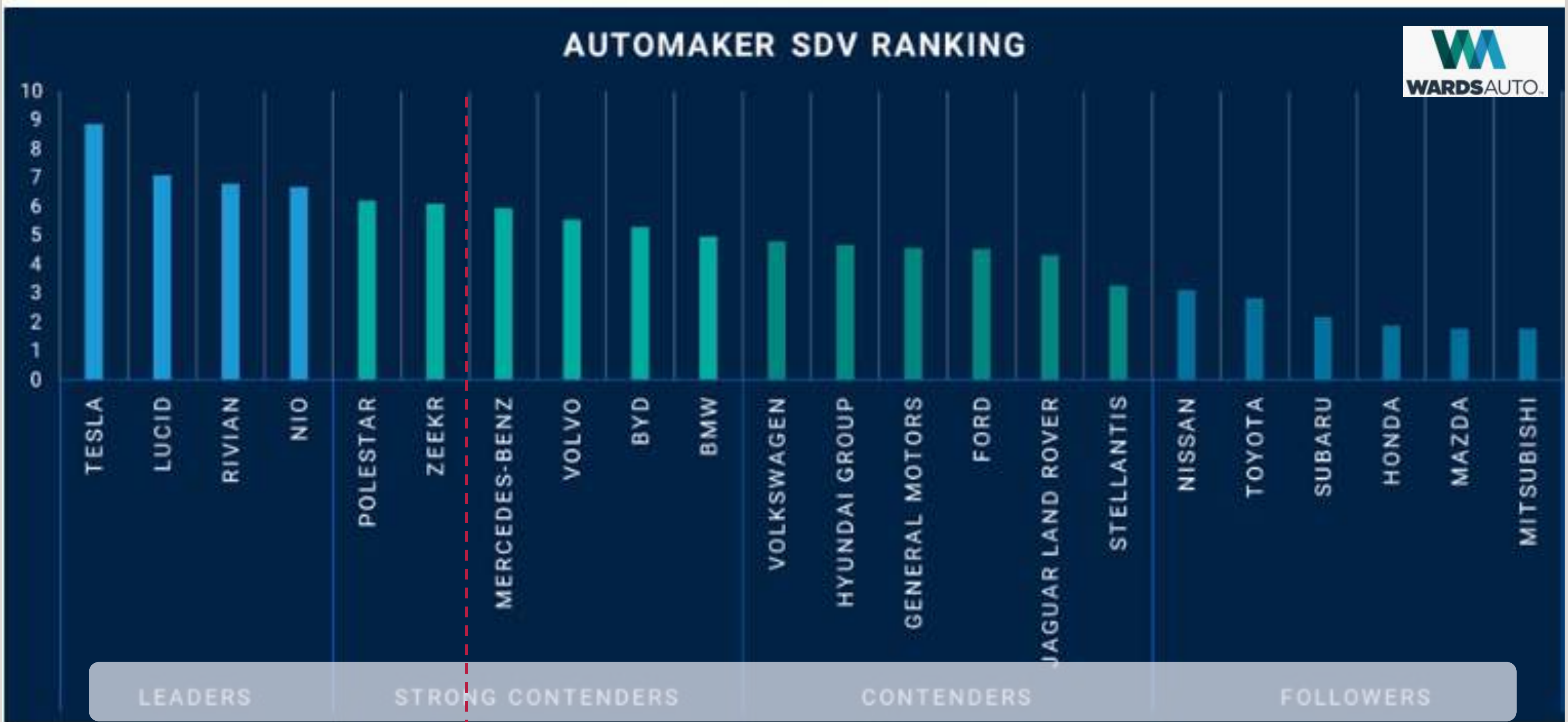
Traditional product development will struggle to adjust to the new reality

- Own Software stacks
- Design own chips
- Manage Cloud

More Control & Flexibility
to
Innovate

In-house resources/skill sets: Software based Innovation & Hardware Competence

RECENT WARDS AUTO RANKING OF OEMS ON SDV PROGRESS



EV Only, Clean sheet

Traditional, Established ICE business, Evolving

OTHER TRANSFORMATION TAKING PLACE…..

- Growing acknowledgment of the complexities – between Tech & Auto

✓ Better appreciation for safety & reliability

✓ More software talent & leadership migrating to automotive

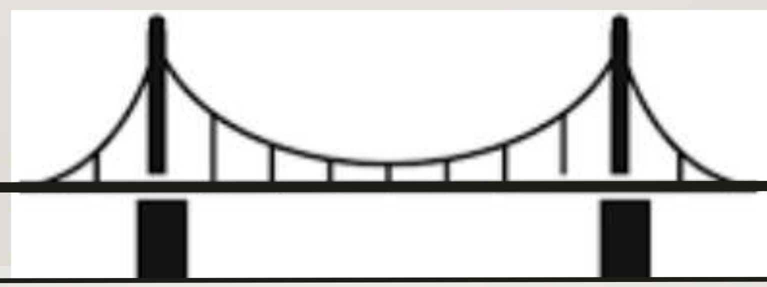
✓ VC & startup culture finding stronger roots in automotive

2023 Detroit Ranking*
Startup Eco-system

StartupBlink

Evolution of a more robust bridge

Traditional Auto Industry



Technology Industry

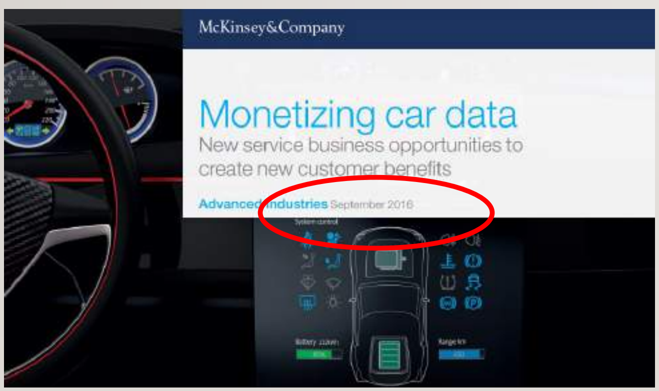
Detroit, Stuttgart, Tokyo…

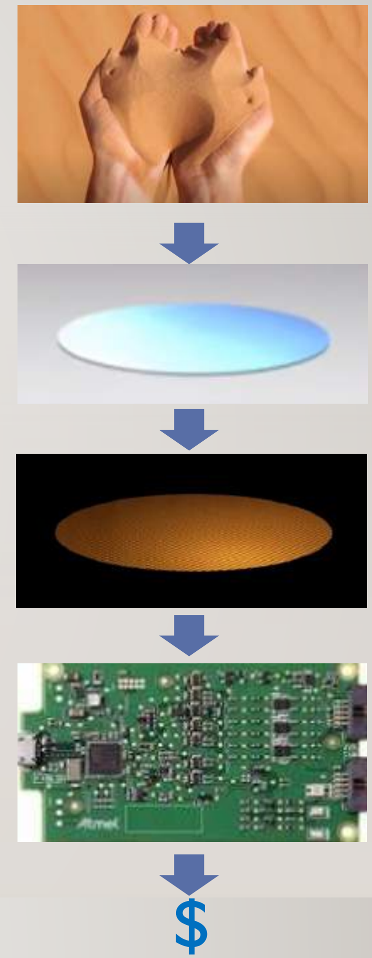
Silicon Valley, Tel Aviv, Berlin..

*https://www.startupblink.com/startup-ecosystem/detroit-mi-us

WHERE DO DATA FIT IN THIS TRANSITION?

- Data - **New oil** or **new sand** or **new gold**?
  - **Value** not in the commodity but in innovation off the data
- Industry is still far from this goal
  - Predictions going back to 2016 are yet to materialize





THE MISSED DATA MONETIZATION OF SDV EVOLUTION*

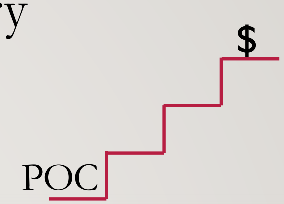
Fragmentation of industry-wide data	Many OEM-specific APIs and data formats
Fragmentation due to siloed organization	Structured along vehicle function silos Cross-functional data monetization is difficult
Limited data based services	Some of the services are available for free in the smartphone world
Success stories may be one off	UBI & pay-per-use insurance by one OEM; e-Commerce deal with a single gas station brand

Open standards/APIs Interoperability → **Mitigate fragmentation & realize the potential of data**

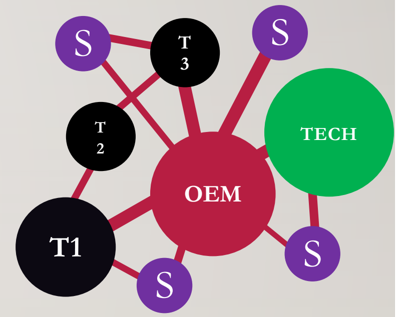
* Source: Dr. Moritz Neukirchner -Elektrobit (Linked-In: July 2023)

SUMMARY

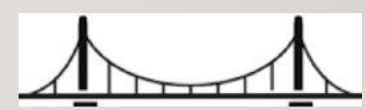
- **SDV**: The biggest transformation of the automobile in a century
  - ✓An enabler to accelerate the progress of C.A.S.E
  - ✓The transition will be slower than anticipated
  - ✓Speed of adoption would be different for different OEMs



- **Value Chain Shift**: Tiered structure to a networked eco-system



- **Synergy between Auto & Tech**: A stronger cross-pollination



- **Data**: SDV architecture, by definition will facilitate better data management and new value creations → Open standards/APIs & Interoperability to realize this potential

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PG Mobility Analysis