Highlights

Our September Enterprise Storage Newsletter is all about cars, traffic, smart grids, and what these technologies mean for data storage and meaningful data analytics. What are the data and storage demands for this effort – and which comes first, individual company innovation or a collective push for the infrastructure to meaningful support these innovations? Perhaps meaningful climate change objectives can be accomplished with EVs and smart grid infrastructure minus the mass transit portion. (Because we like our cars.)

Our G2M Multi-Vendor Webinar Series 2022 schedule is available at the end of our newsletter and on our www.g2minc.com website. We have some exciting topics coming up. We also provide a list with links up upcoming Enterprise Storage events, although most continue to be virtual.

Cheers! Mike Heumann

Hate the Traffic;

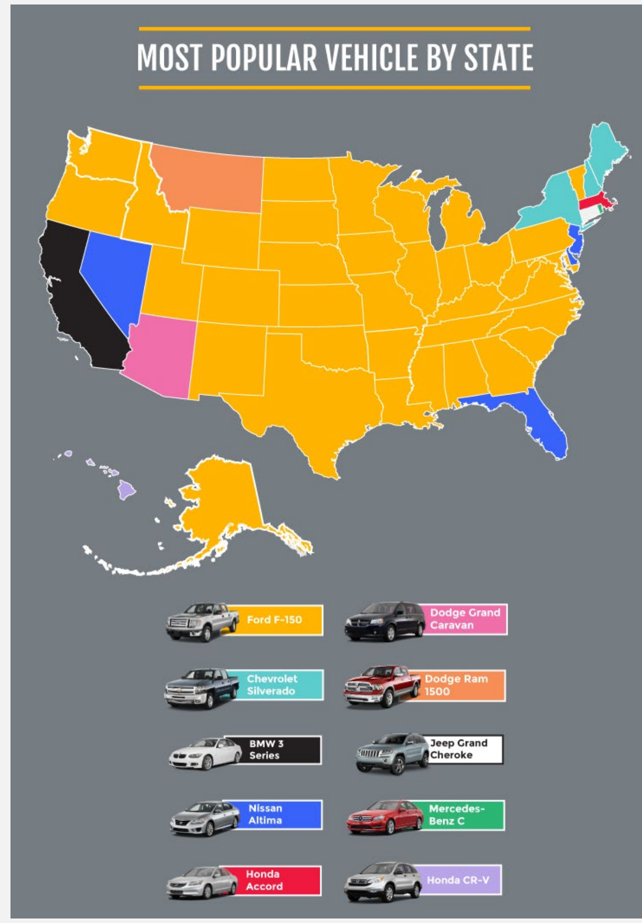
Love my Car

Mass public transportation has failed miserably in the United States, not because we cannot do it; we don't want to - in part because we like our cars. Exciting news on the space front includes plans by Elon Musk to launch 100 people at a time to Mars, aboard his spacecraft, Starship. Try getting 100 southern Californians onto a bus. Not happening.

Not to say that investment in transit is bad – quite the contrary. There are plenty of examples from around the world where transportation options are reliable, attractive, functional, affordable, and embraced by the public. People seem very excited about public transportation options in space. You have to create something worth using to push the public in that direction. The concept – if you build it, they will come.

And, if for the time being, technology will come to the car instead of the commuter to the transit, a challenge for advances in EVs, autonomous vehicles, or any smart car technology is the lack of the infrastructure– city, regionally, state-wide – to make it happen in any large sense. What does the infrastructure to support truly functional mass transportation, autonomous, and electric vehicles options look like? What are the data and storage demands for this effort – and which comes first, individual company innovation or a collective push for the infrastructure to meaningful support these innovations?

The Ford F-150 truck is the undeniable winner for the vast majority of the country - the most popular vehicle in 39 of the 50 states. California drivers favor the BMW S series.
Rural markets, independence, speed and convenience make us a driving market versus as a mass transit market, for the time being. Climate change? No worries, Ford in in pre-production of its electric version of the F-150.



The greatest engineering achievement of the 20th Century, according to the National Academy of Engineering is Electrification. And, when you consider the list, many of these technologies work in concert and, with aggressive investment and innovation, will connect in ways that contribute far beyond what each can contribute alone.

1. Electrification
2. Automobile
3. Airplane
4. Water Supply and Distribution
5. Electronics
6. Radio and Television
7. Agricultural Mechanization
8. Computers
9. Telephone
10. Air Conditioning and Refrigeration
11. Highways
12. Spacecraft
13. Internet
14. Imaging
15. Household Appliances
16. Health Technologies
17. Petroleum and Petrochemical Technologies
18. Laser and Fiber Optics
19. Nuclear Technologies
20. High-Performance Materials

Data Storage in Cars

A car can generate about [25GB of data] every hour and as much as 4TB a day, according to some estimates. This data is estimated to be worth as much $750B by 2030. Even without autonomous vehicles or everything electrified, cars have many computer systems and technologies controlling and storing data. DRAM and NAND solutions to handle these processes.

DRAM tends to be faster, with greater bandwidth for adaptive driving technologies while NAND is slower, nonvolatile memory - integral to navigation, customization, accident and collision information.

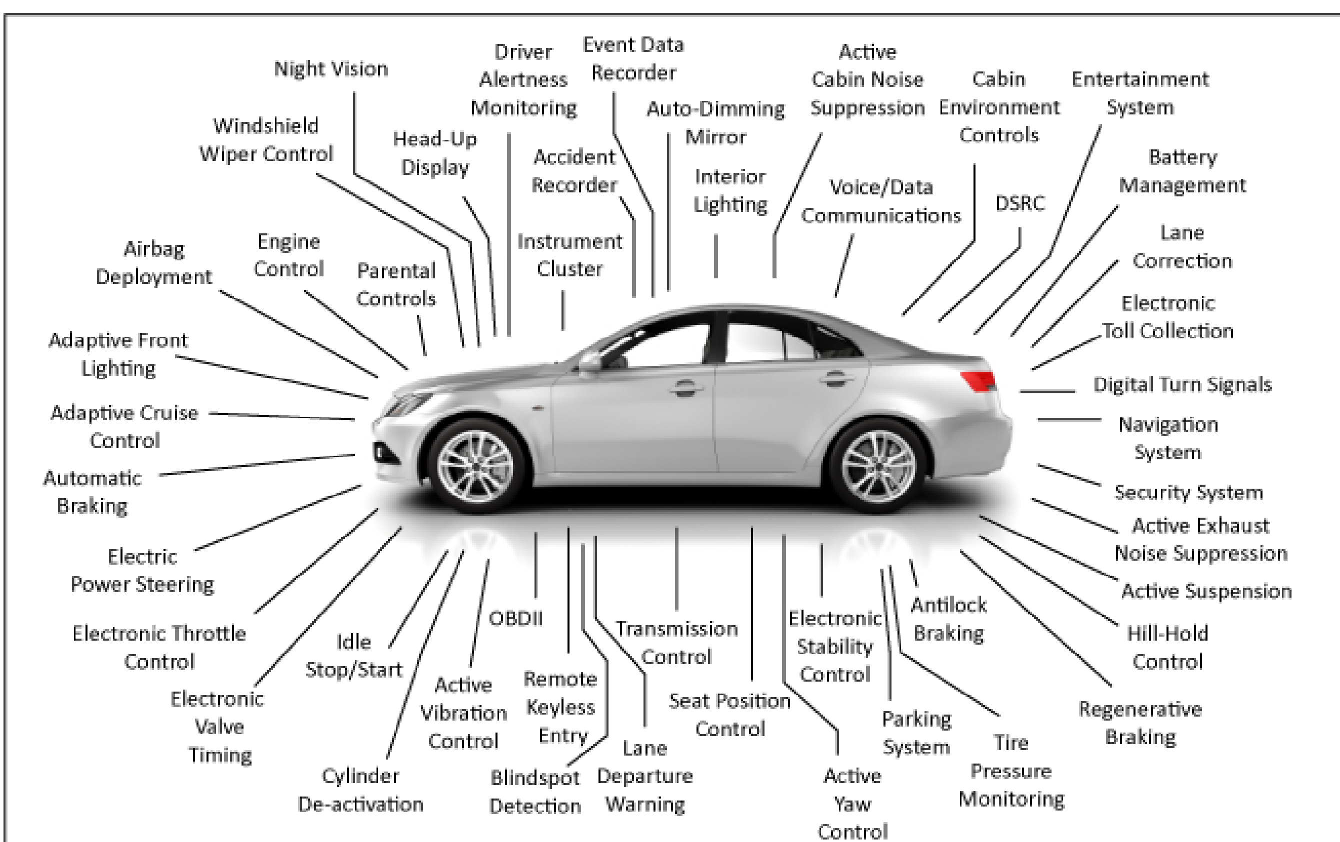
The largest NAND flash memory manufacturers: Samsung – 29.9%, Kioxia – 20.2%, Micron Technology– 16.5%, Western Digital (SanDisk) – 14.9%, SK Hynix – 9.5%, Intel – 8.5%.

UFS (Universal Flash Storage) – responsive, advanced flash memory, multitask, durable, scalable.

eMMC (Embedded Multi-Media Card) – low cost, faster than SD Cards for smaller datasets, fragile.

Tesla will recall every Model S and Model X vehicle shipped with an 8GB eMMC NAND flash chip. NAND flash is rated for a fixed number of write cycles and the amount of data logged by Tesla cards will wear out the NAND flash, causing failure of the Medial Control Unit, which controls the rearview camera display, defrost/defog, and exterior turn signal lighting).

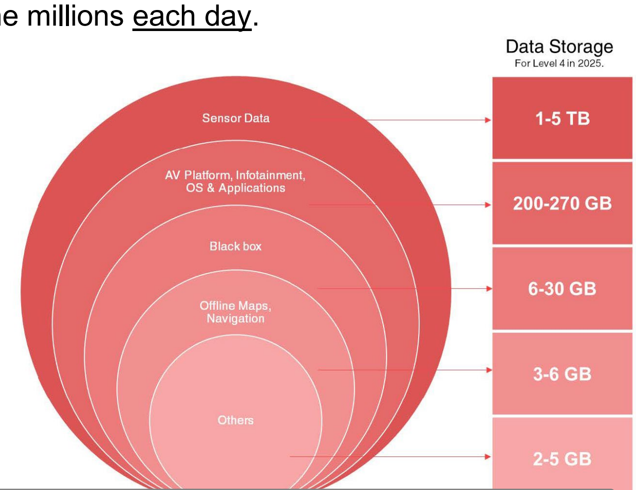
SD Card – faster for large files, handle shock well, reliable (however temperature, power supply and stability all have a significant impact on SD memory card storage reliability), power efficient, long lasting, easy to use - to swap, update, replace.

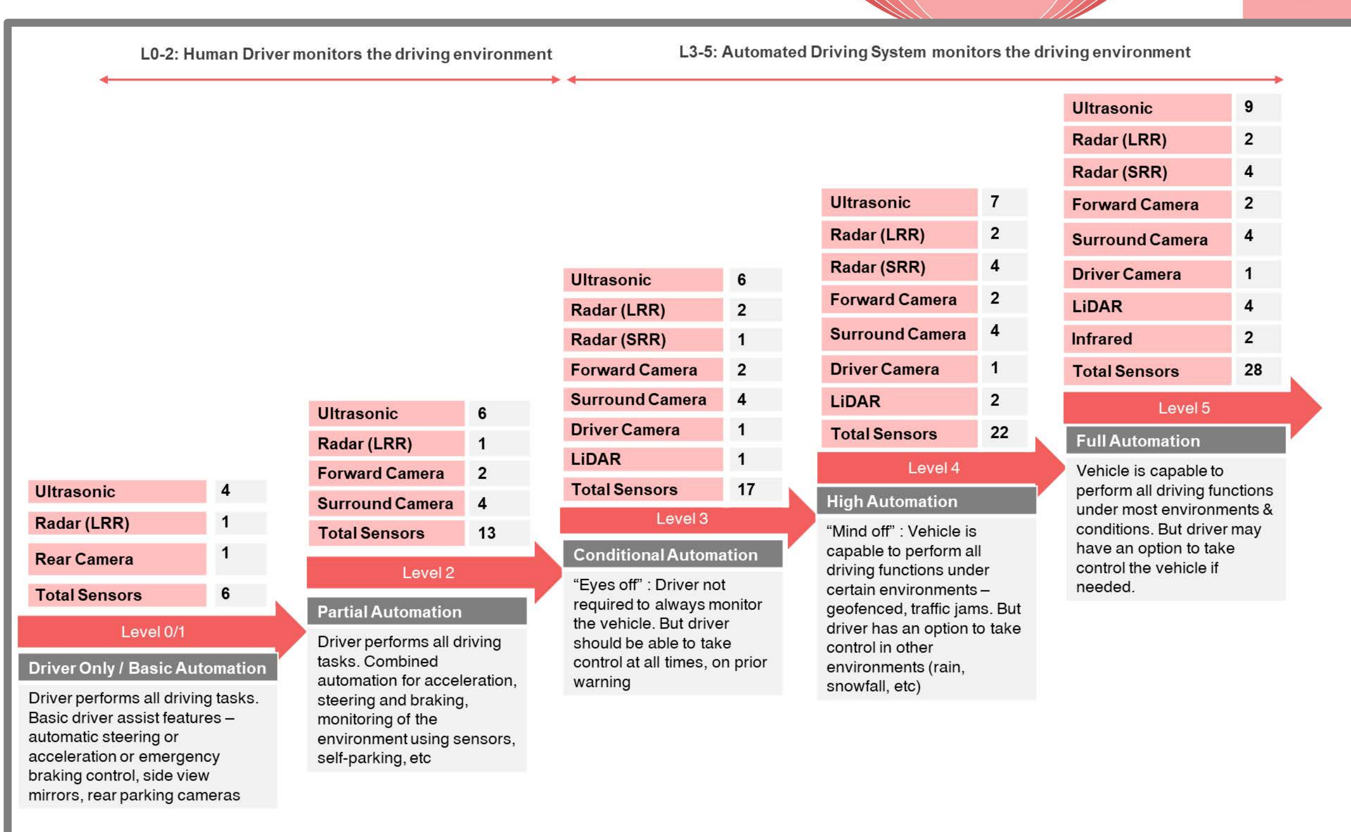


Now, Change the Data Storage Equation to Factor in EVs & Autonomous Vehicles

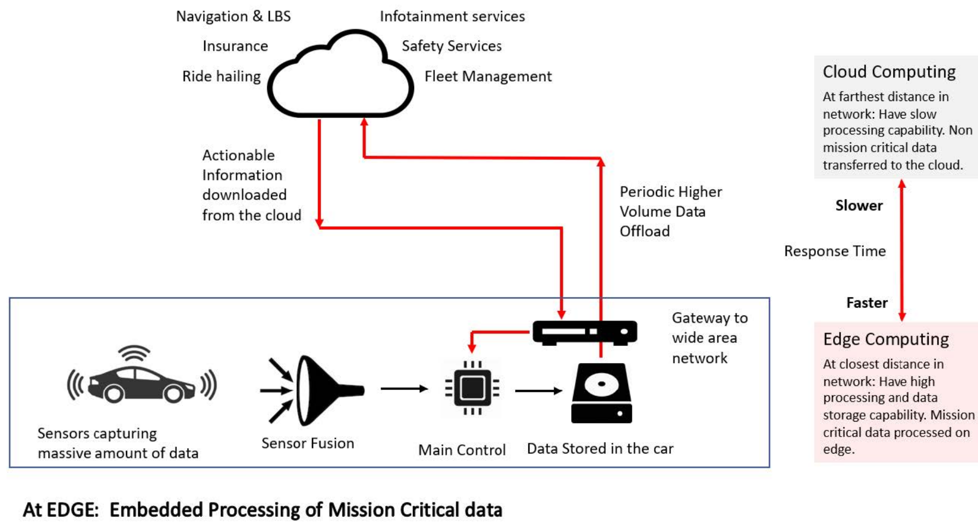
The United States is moving full speed ahead on development of electric vehicles. For us, smart grids may address climate change objectives via smart cities, utilities, and EVs, with little emphasis on a move to mass transit. In the US, 75% of commuters drive alone. China had no rapid transit through 1990 but now has 25 cities with comprehensive rail. The US has 34 miles (total) of high-speed rail. The US spent more than $47 billion on 1,200 miles of new and expanded transit lines from 2010 to 2019 (mostly on bus routes). The United States constructed over 870K miles of roads between 1950 and 2017 (to the moon and back – almost twice). Cities such as Dallas and Portland have light rail systems and several other large cities have combined light and commuter rail. Contrast that with the Grand Paris Express and Crossrail in London, each with ridership in the millions each day.

The fact is that people in the states do not rely on mass transit the way they do in other parts of the world. Data storage and computing infrastructure needs for vehicles are rapidly changing. The storage requirements for electric vehicles will range from 2TB to 11TB to support different automotive autonomy levels. Vehicles will be designed to gather, process, and store more and more data, both locally as uploaded to the cloud.





There will be infrastructure needs for transmission of stored data to the cloud to build machine learning models and drive new services. Level 3 and above autonomous vehicles will use a combination of cloud and edge computing to optimize the requirements of AI computing systems, real-time response, and transmission costs. Experts believe in-vehicle storage will move from SLC/MLC NAND to UFS/embedded SSD for Level 3 to Level 5 autonomous vehicles.



Smart Grids

According to the US Department of Energy, today's electricity system is 99.97% reliable but power outages and interruptions still cost $150B each year. Thirty states have developed and adopted renewable portfolio standards. The American Public Power Association task force is developing a framework for a Smart Grid technologies in a public-power environment.

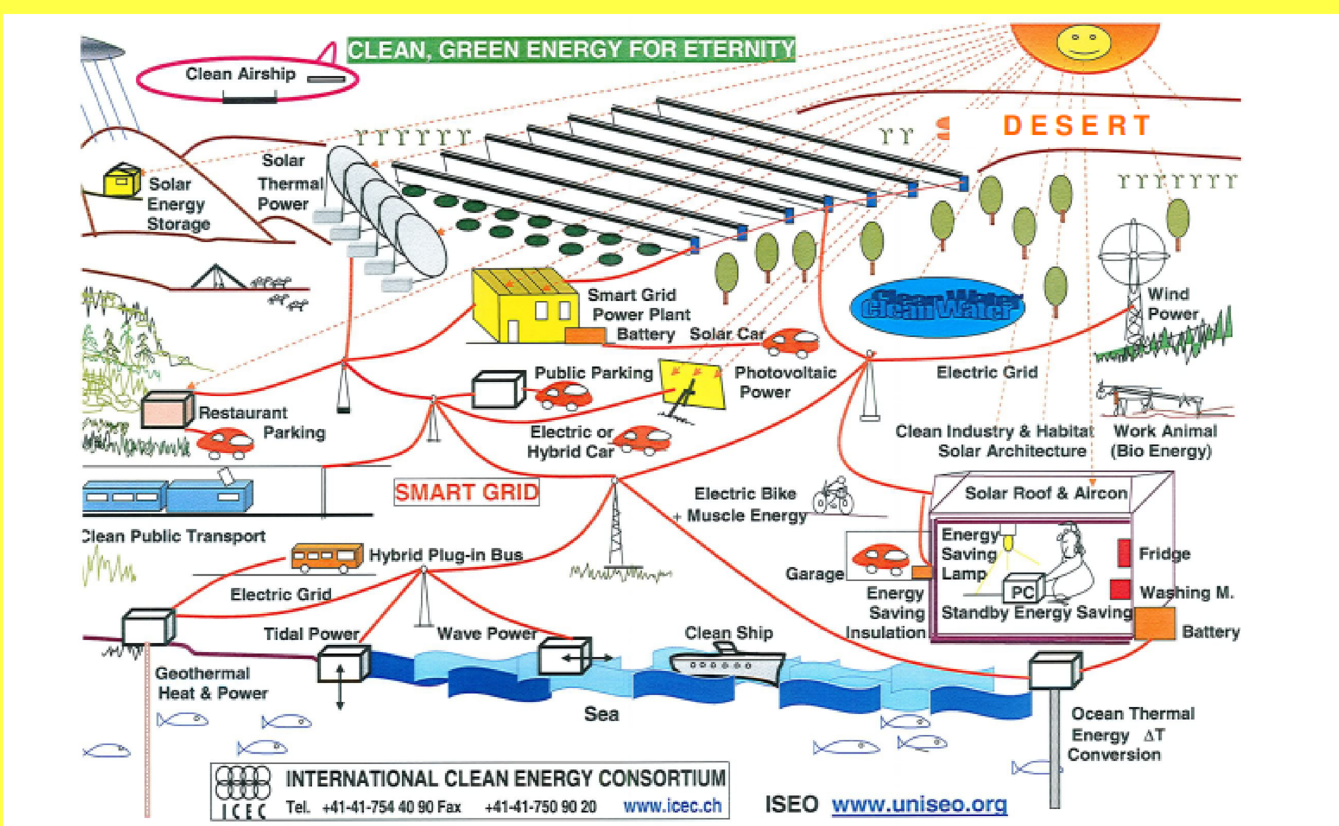
In 2020, global spending on smart cities initiatives were nearly $124B and is expected to be close to $190B by 2023. Singapore was the top investor, then Tokyo, followed by New York City and London. Each of the four spent more than $1B with the largest share of that investment on smart grids. The United States, Western Europe, and China account for over 70% of investment on smart cities, though Latin America and Japan had the fast growth in spending.

The connected nature of smart grids makes them valuable and creates new security risks. In a traditional electrical grid, power flows only in one direction, from centralized facilities to the customers via distribution utilities. "While the distributed nature of many new technologies diminishes the criticality of any single asset, the informational capabilities inherent to these devices carry vulnerabilities that were unknown previously," National Institute of Standards and Technology, NIST states. "The large number of non-utility stakeholders and increasing number of devices connected to smart grids means that — even in the best of circumstances — secure operations can no longer be guaranteed by a single organization or security department.”

Smart grids can provide “*more efficient transmission of electricity as well as quicker restoration after power disturbances. The smart grid also improves reliability and safety of the electric transmission and distribution grid via connected assets. Utilities benefit from reduced operations and management costs, which in turn means lower power costs for consumers. The smart grid also integrates with customer-owned power generation systems, including renewable energy systems. Pervasive communications is critical for smart cities in general and smart grids in particular. At the most basic level, the network that is deployed by the utility in support of smart grids could be extended by the municipality to deploy other essential public services such as smart city lighting, traffic and water solutions.*”

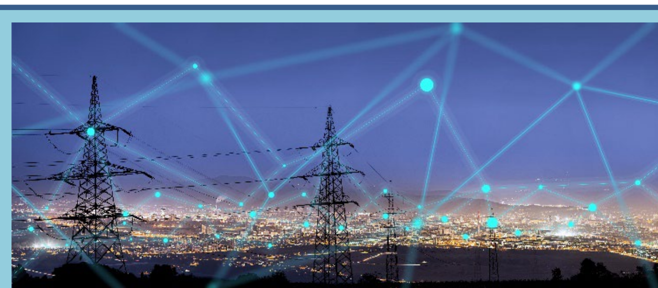
Jeffrey Tufts, Global Energy Solutions Executive, Cisco Systems

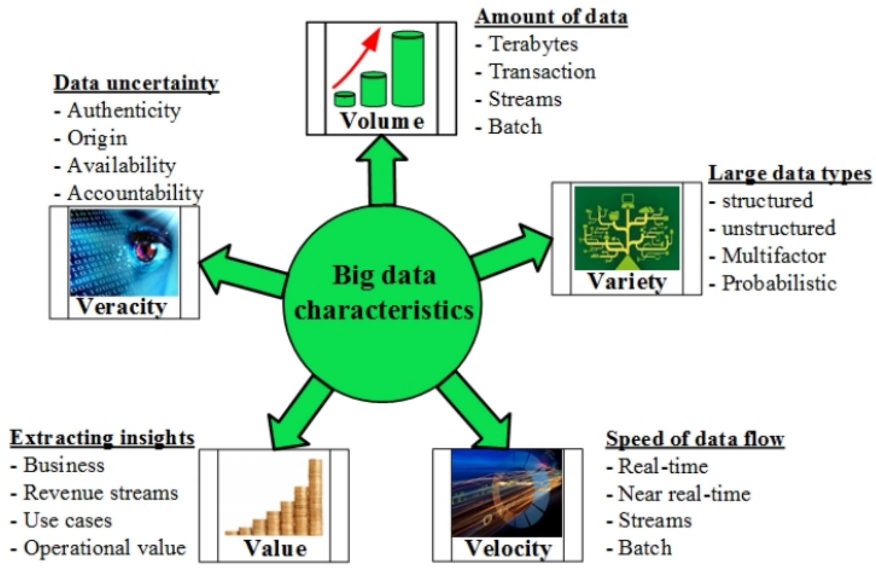
Maybe the smart grid connection for the US is in EVs, utilities, traffic monitors, solar, meeting climate change objectives without the need for mass transit. If you don’t invest in the transit you can never know whether if you build it, they will come. And, yet, I admit, I prefer to keep my car, EV or otherwise.



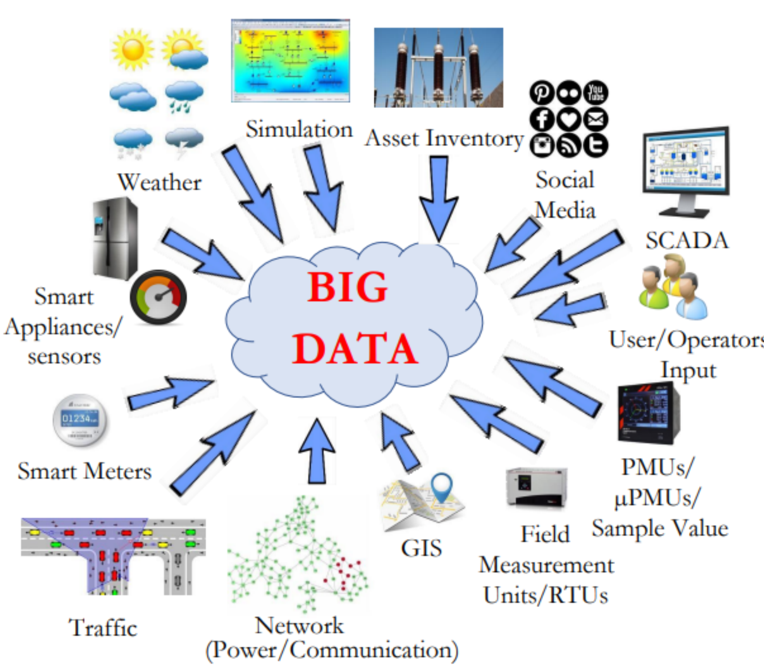
The complexity of the future global sustainable energy system intelligently interlinking a multitude of decentralized clean energy sources with efficient stationary users and electric vehicles with millions of buffer batteries

Smart Grid Data Analytics Opportunities





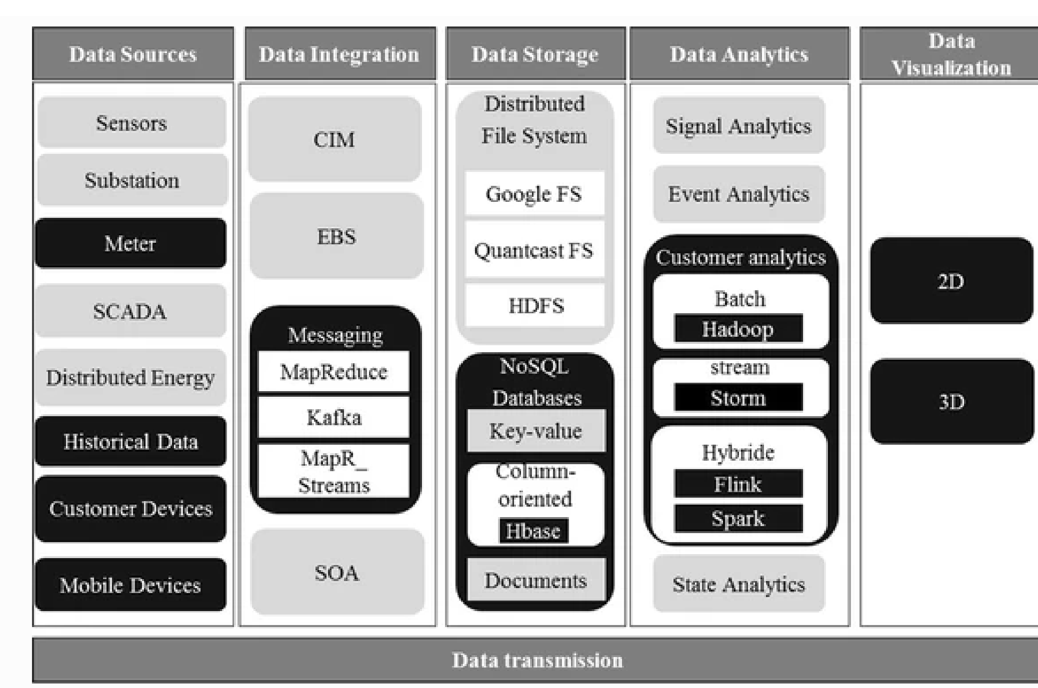
Conventional electric grids have limited measurement and control capabilities. A smart grid optimizes the generation, distribution, and consumption of electricity though shared information and communication technologies. Smart grid big data is characterized by high volume, wide varieties of structured and unstructured data, varying velocity from real-time upward, veracity inconsistencies such as redundancies and missing data, and varying values. It is necessary to process large volume and varieties of real-time and historical data to make meaningful data-driven decisions. Smart grid data analytics provide opportunities for efficient operation, controlling grid assets, distributed energy resources, end user energy consumption in real time, planning processes, and new business models.



There are various sources of smart grid data. Applications of that data include energy management, improved grid reliability and stability, real-time monitoring, planning, optimizing asset use, accuracy of crisis management decision-making (relying on real-time, large datasets), faster and more accurate information sharing.

A report from the Electric Advisory Committee of the US Department of Energy indicates, “The legacy EMS, ADMS, market management systems, asset management systems, and back-office systems are not designed with big data analytics requirements in mind. The cost recovery approach for updating such systems to accommodate big data and related analytics needs to rapidly evolve (e.g., capital vs. operations and maintenance expenses).” Challenges, issues, and potential solutions to applying big data analytics to smart grids:

Challenges	Issues	Potential Solution
Data volume	Need for increased storage & computing resources, flexibility scalability	Dimensionality reduction, parallel computing, edge computing, cloud computing, pay-per-use, distributed file system, NoSQl databases
Data availability	Need immediate and accurate access to data, distributed storage capacity	Redundancy & resilience in networks, servers, physical storage and storage systems parameters (storage nodes), batch, real-time, and hybrid processing tools
Data quality	Lack of complete information, misleading decision	Probabilistic and stochastic analysis, data cleaning
Security	Vulnerable to attack, compromise consumer privacy/integrity	Data anonymity, aggregation, encryption, compliance with platform requirements
Performance (latency)	Impact operational decision, errors in interpretation of data	Single transaction, synchronize devices
Indexing	Computational complexity and long processing time	Deploy new indexing techniques
Value proposition	Non-acceptance by stakeholder, delayed deployment of big data	Quantifying technical and economic values to key stakeholders (consumer, systems operator, utility)
Standards & regulations	Interface challenges among computing, storage, processing platforms, delayed deployment	Regulatory guidelines and standards for data sharing/exchange



“However, big data analytics is more than just data management; it is rather an operational integration of big data analytics into power system decision-making frameworks. Therefore, the key challenge of big data analytics is to turn a large volume of raw data into actionable information by effectively integrating into power system operational decision frameworks.”
From IET, Big data analytics in smart grids: state-of-the-art, challenges, opportunities, and future directions.

Where Has NVMe-oF Progressed to in 2021?

with sponsors Lightbits Labs and KIOXIA

What experience does your organization have with NVME-oF? (check all that apply):

Explored information on its use (conferences, articles, etc):	58%
Talked to NVMe-oF vendors (NW adapters, storage, software):	27%
Defined potential NVMe-oF projects:	21%
Started one or more proof-of-concept evaluations:	24%
Budgeted for actual production of NVMe-oF deployments:	9%
NVMe-oF in production:	27%

Which classes of NVMe-oF use cases has your organization evaluated? (check all that apply):

Scale-out Flash Storage deployments (servers and/or storage appliances with local storage in a single common namespace):	64%
Deployment of all-flash arrays with NVMe-oF back-ends:	50%
Deploying NVME-oF into existing or new networked storage configurations:	64%
Other use cases (converged infrastructure, etc.):	48%

G2M RESEARCH

G2M Research Multi-Vendor Webinar Series

Our webinar schedule is below, including our schedule for 2022. Click on any of the topics to get more information about that specific webinar. You can view all our webinars and access all the slide deck presentations

Interested in sponsoring a webinar? Contact **G2M** for a prospectus.

We also host custom webinars and webinar series as another highly effective approach to reach your target audience – before the webinar(s) with direct and social media marketing, during the webinar with a customized presentation and audience polls, and after the webinar with use of the recording and presentation materials for outreach. Join us for our KIOXIA series (dates and details soon).

Oct 12:	Cloud Service Providers: Is Public Cloud, Private Datacenter, or a Hybrid Model Right for You?
Nov 9:	The Radiometry Data Explosion: Can Storage Keep Pace?
Dec 14:	2021 Enterprise Storage Wrap-up Panel Discussion
Feb 1:	Storage Architectures for High-Performance Computing
Feb 15:	Cybersecurity: Zero Trust or Trust Your People
March 8:	Storage Architectures for AI & ML
March 29:	Storage Technologies for Datacenters in Space
April 26:	Effective Architectures for Edge Computing & Storage
May 24:	Data, Networking, & Storage Acceleration
June 21:	Scaling Storage Capacity & Bandwidth Effectively
July 19:	Hot Semiconductor Startups: Changing the Rules
Aug 23:	Advanced NVMe SSDs
Sept 13:	Public/Private Storage Architectures for CSPs
Oct 11:	Storage Fabrics for Mega-Datacenters
Nov 8:	Securing Cloud Datacenters Resources
Dec 13:	What was Hot (or Not) in 2022, and Predictions for 2023

Enterprise Storage Events

September 28-29	SDC21, Virtual
October 5-7	VMworld, Virtual
October 6-7	Digital Transformation Expo Europe, London
October 6-7	P99 Conf, Virtual
October 20-22	NetApp Insight, Virtual
October 26-28	MWC Los Angeles
November 2-4	Microsoft Ignite, Virtual
November 9-10	OCP Global Summit, San Jose
November 15-18	SC21, St Louis
November 29- Dec 3	Amazon re:Invent, Vegas
January 26-28	SNIA 2021 Annual Members Symposium, Virtual
February 7-10	RSA Conference, San Francisco & Virtual
February 28- March 3	MWC Barcelona
March 2-3	Cloud Expo Europe, London
April 23-27	NAB, Vegas

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