Flash in vehicles: end-user's perspective

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Automotive flash needs

- Robustness:
  - temperature
  - vibration
- Predictability:
  - read-write transaction time
  - component lifetime
- Visibility:
  - health statistics
  - testability

SMART monitoring of SSD

SMART Attributes Data Structure revision number: 1

NAME	VALUE	WORST	THRESH	TYPE	RAW_VALUE
Reallocated_Sectors	100	100	010	Pre-fail	0
PowerOn_Hours	099	99	000	Old_age	157
Power_Cycle_Cnt	099	99	000	Old_age	15
Wear_Leveling_Cnt	100	100	000	Pre-fail	0
Program_Fail_Cnt	100	100	010	Old_age	0
Erase_Fail_Count	100	100	010	Old_age	0
Runtime_Bad_Block	100	100	010	Pre-fail	0
Uncorrectable_Errors	100	100	000	Old_age	0
Airflow_Temperature	67	64	000	Old_age	33
ECC_Error_Rate	200	200	000	Old_age	0
CRC_Error_Count	100	100	000	Old_age	0
POR_Recovery_Count	99	99	000	Old_age	10
Total_LBAs_Written	99	99	000	Old_age	204813376

Compare auto-grade SPI-NOR

```
root@nitrogen:~# ls /sys/class/mtd/mtd0
bad_blocks          device          flags           oobsize      type
bbt_blocks          ecc_failures    mtdblock0       power        uevent
bitflip_threshold   ecc_step_size   name            size         writesize
corrected_bits      ecc_strength    numeraseregions subpagesize
dev                 erasesize       offset          subsystem
root@nitrogen:~# cat /sys/class/mtd/mtd0/type
nor
root@nitrogen:~# cat /sys/class/mtd/mtd0/size
786432
root@nitrogen:~# cat /sys/class/mtd/mtd0/bad_blocks
0
```

Much less information!

Unmet need: storage EVMs

OM13081 - Evaluation Module, Sensing, Touch, Proximity, Capacitive Touch, 8bit Touchpad w / 9 Keys, LCD

Clustered or distributed architectures?

http://tinyurl.com/ybovp4lb

-- More storage devices, near sensors and actuators.

-- Filter sensor data before fusing.

-- Slower buses, shorter latency?

-- Higher BOM?

http://tinyurl.com/yddb3jlf

-- Fewer, larger devices.

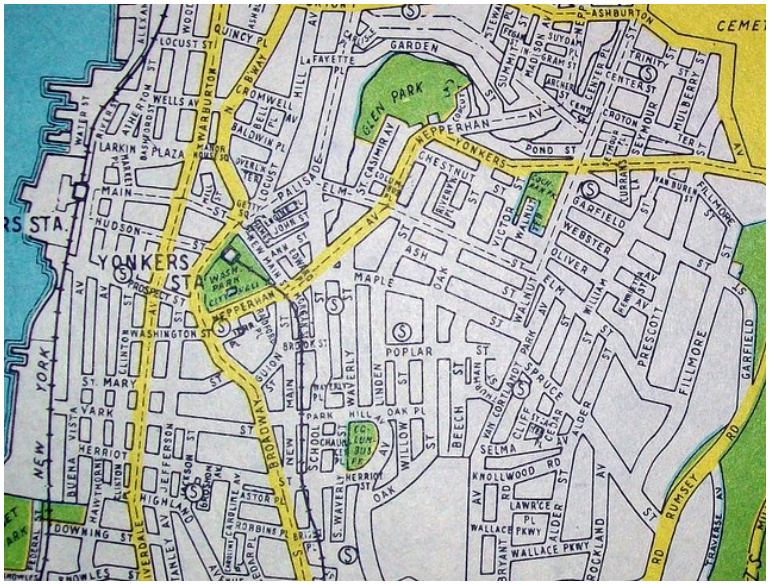
-- Transfer data before processing.

-- Needs faster network, virtualization.

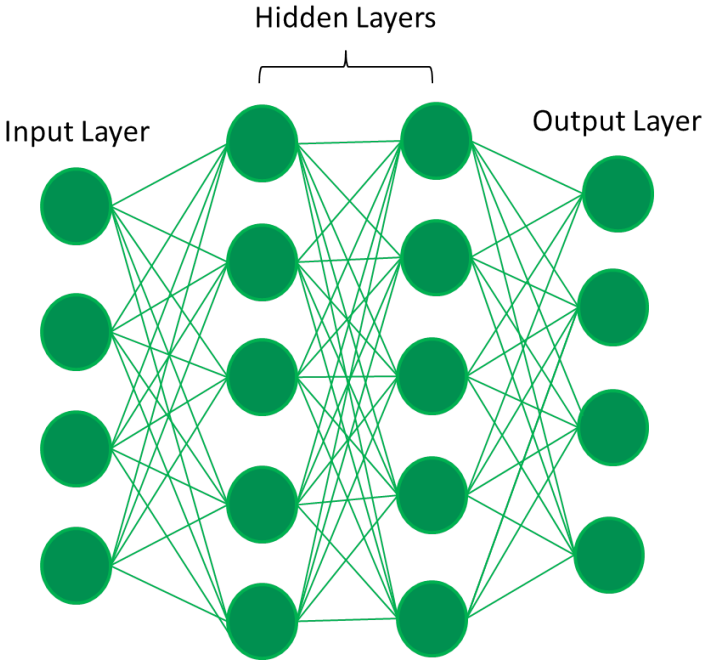
-- Unproven in production.

Map- or model-based decisions?

http://tinyurl.com/y97qefm2



-- Based on 'knowing where you are'.
-- Big database of locally cached results.



http://tinyurl.com/yc2u4qlx

-- Based on 'what I can see.'
-- Small database of model coefficients.

Summary

- Most important: reliability, predictability, testability.
- Manufacturers have some opportunities to improve usability.
- Vehicle system architecture choices influence flash requirements.