The joy and misery of connecting a car to the internet

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but why?

but why?

- Because we can

but why?

- Because we can
- To know more about your car

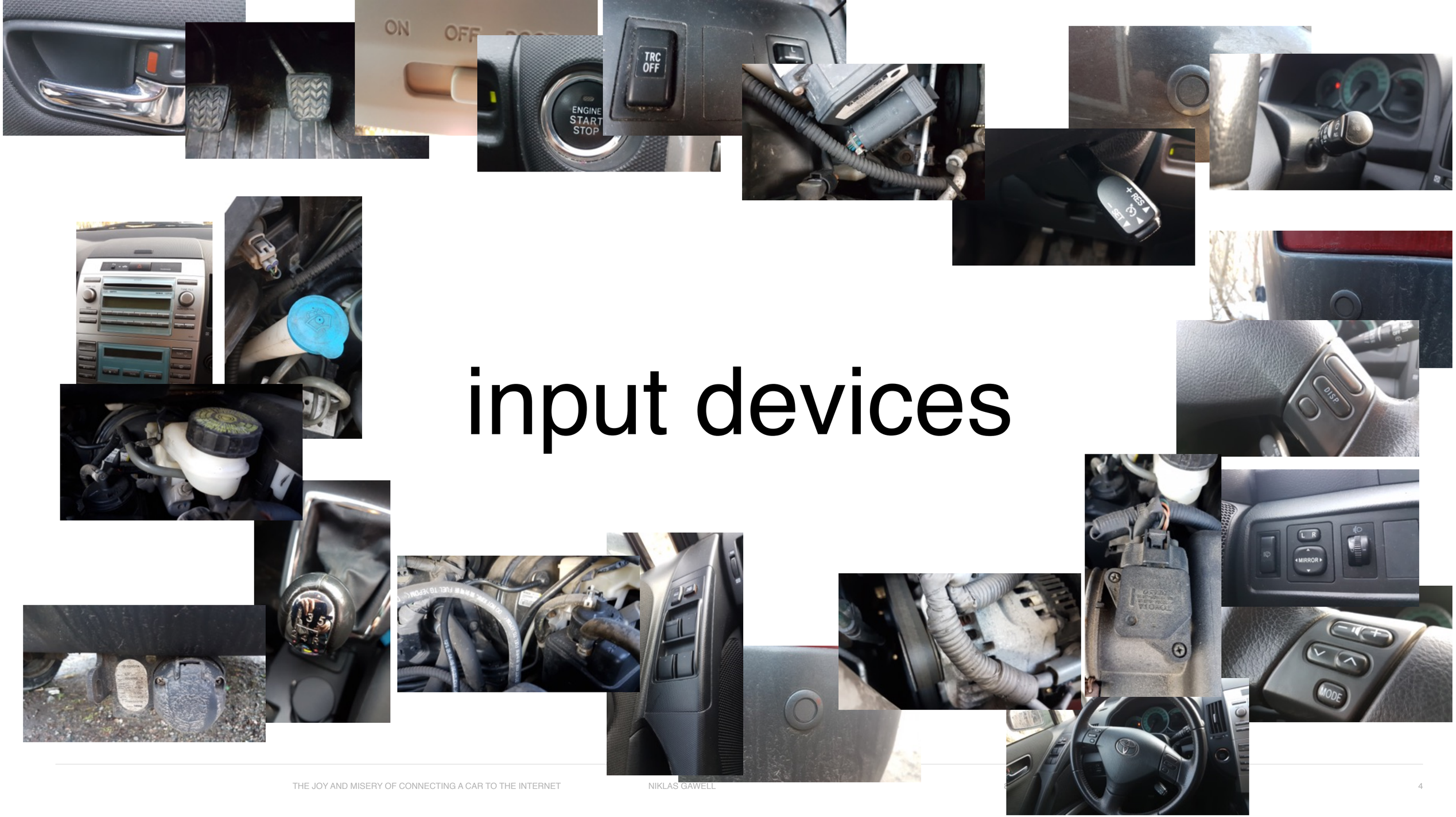
but why?

- Because we can
- To know more about your car
- To do more with your car

let’s look at an example

let’s look at an example

input devices



input devices

output devices

output devices

interconnectivity

interconnectivity

interconnectivity

interconnectivity

interconnectivity

CAN et. al.

0100110101

network connector

Let’s get connecting!

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6	2017-01-01	20:11	2017-01-01	20:21	7.3	Ängsviksvägen 2, 139 50 Värmdö, Sverige	Boda byväg 2B, 139 90 Värmdö, Sverige
7	2017-01-02	15:33	2017-01-02	15:58	18.5	Boda byväg 2B, 139 90 Värmdö, Sverige	MEDEAS VÄG 1, 134 44 Gustavsberg, Sverige
8	2017-01-02	16:40	2017-01-02	17:11	18.7	Afreditres väg 4, 134 44 Gustavsberg, Sverige	Boda byväg 2B, 139 90 Värmdö, Sverige
9	2017-01-05	09:39	2017-01-05	10:12	21.7	Boda byväg 2B, 139 90 Värmdö, Sverige	Ösby badväg 3, 134 38 Gustavsberg, Sverige
10	2017-01-05	12:10	2017-01-05	12:18	3.5	Ösby badväg 3, 134 38 Gustavsberg, Sverige	222, 134 44 Gustavsberg, Sverige
11	2017-01-05	12:21	2017-01-05	12:25	1.0	222, 134 44 Gustavsberg, Sverige	ORIONS VÄG 6, 134 44 Gustavsberg, Sverige
12	2017-01-05	12:52	2017-01-05	12:56	0.8	MEDEAS VÄG 1, 134 44 Gustavsberg, Sverige	Fenix väg 4, 134 44 Gustavsberg, Sverige
13	2017-01-05	13:14	2017-01-05	13:21	3.4	Fenix väg 4, 134 44 Gustavsberg, Sverige	Viks skolväg 22, 139 35 Värmdö, Sverige
14	2017-01-05	13:25	2017-01-05	13:45	15.7	Viks skolväg 22, 139 35 Värmdö, Sverige	Boda byväg 2B, 139 90 Värmdö, Sverige
15	2017-01-06	19:17	2017-01-06	19:37	14.3	Boda byväg 2B, 139 90 Värmdö, Sverige	Skärgårdsvägen 262, 139 30 Värmdö, Sverige
16	2017-01-06	19:55	2017-01-06	19:58	1.0	Skärgårdsvägen 266, 139 30 Värmdö, Sverige	Centrumvägen 1, 139 30 Värmdö, Sverige
17	2017-01-06	20:03	2017-01-06	20:06	1.8	Centrumvägen 1, 139 30 Värmdö, Sverige	Torsby Älgstig 1-3, 139 51 Värmdö, Sverige
18	2017-01-06	20:18	2017-01-06	20:34	12.3	Torsby Älgstig 1-3, 139 51 Värmdö, Sverige	Boda byväg 2B, 139 90 Värmdö, Sverige
19	2017-01-07	13:45	2017-01-07	14:06	16.0	Boda byväg 2B, 139 90 Värmdö, Sverige	Skärgårdsvägen 220, 139 35 Värmdö, Sverige
20	2017-01-07	16:18	2017-01-07	16:21	1.7	Skärgårdsvägen 220, 139 35 Värmdö, Sverige	Skärgårdsvägen 268, 139 30 Värmdö, Sverige
21	2017-01-07	16:36	2017-01-07	16:44	6.3	Skärgårdsvägen 268, 139 30 Värmdö, Sverige	Oxövägen 2F, 139 50 Värmdö, Sverige
22	2017-01-07	16:47	2017-01-07	16:58	7.9	Oxövägen 2F, 139 50 Värmdö, Sverige	Boda byväg 2B, 139 90 Värmdö, Sverige
23	2017-01-09	07:35	2017-01-09	07:46	7.5	Boda byväg 2B, 139 90 Värmdö, Sverige	Ängsviksvägen 7, 139 50 Värmdö, Sverige
24	2017-01-09	07:52	2017-01-09	08:17	15.2	Ängsviksvägen 9, 139 50 Värmdö, Sverige	Idrottsvägen 4A, 134 40 Gustavsberg, Sverige
25	2017-01-09	15:53	2017-01-09	16:03	4.3	Idrottsvägen 4A, 134 40 Gustavsberg, Sverige	Skärgårdsvägen, 134 44 Gustavsberg, Sverige
26	2017-01-09	16:13	2017-01-09	16:21	3.5	Skärgårdsvägen, 134 44 Gustavsberg, Sverige	Viks skolväg 22, 139 35 Värmdö, Sverige
27	2017-01-09	16:23	2017-01-09	16:35	8.2	Viks skolväg 22, 139 35 Värmdö, Sverige	Ängsviksvägen 8, 139 50 Värmdö, Sverige
28	2017-01-09	16:49	2017-01-09	17:01	7.5	Ängsviksvägen 6-8, 139 50 Värmdö, Sverige	Boda byväg 2B, 139 90 Värmdö, Sverige
29	2017-01-10	07:43	2017-01-10	07:54	7.5	Boda byväg 2B, 139 90 Värmdö, Sverige	Ängsviksvägen 8, 139 50 Värmdö, Sverige
30	2017-01-10	08:05	2017-01-10	08:15	7.0	Ängsviksvägen 8, 139 50 Värmdö, Sverige	18.48571, 59.32247
31	2017-01-10	16:04	2017-01-10	16:13	6.5	18.48574, 59.32245	Oxövägen 2F, 139 50 Värmdö, Sverige
32	2017-01-10	16:21	2017-01-10	16:23	0.5	Oxövägen 2F, 139 50 Värmdö, Sverige	Gillets väg 2, 139 50 Värmdö, Sverige
33	2017-01-10	16:27	2017-01-10	16:40	7.5	Gillets väg 2, 139 50 Värmdö, Sverige	Boda byväg 2B, 139 90 Värmdö, Sverige
34	2017-01-10	17:29	2017-01-10	17:52	16.0	Boda byväg 2A, 139 90 Värmdö, Sverige	Skärgårdsvägen 224, 139 35 Värmdö, Sverige
35	2017-01-10	19:05	2017-01-10	19:25	15.8	Skärgårdsvägen 220, 139 35 Värmdö, Sverige	Boda byväg 2B, 139 90 Värmdö, Sverige
36	2017-01-11	07:34	2017-01-11	07:44	7.5	Boda byväg 2B, 139 90 Värmdö, Sverige	Ängsviksvägen 8, 139 50 Värmdö, Sverige
37	2017-01-11	07:48	2017-01-11	08:14	15.2	Ängsviksvägen 8, 139 50 Värmdö, Sverige	Idrottsvägen 4A, 134 40 Gustavsberg, Sverige
38	2017-01-11	15:58	2017-01-11	16:18	15.1	Idrottsvägen 4A, 134 40 Gustavsberg, Sverige	Oxövägen 2F, 139 50 Värmdö, Sverige
39	2017-01-11	16:29	2017-01-11	16:31	0.5	Oxövägen 2F, 139 50 Värmdö, Sverige	Gillets väg 2, 139 50 Värmdö, Sverige
40	2017-01-11	16:36	2017-01-11	16:49	7.5	Gillets väg 2, 139 50 Värmdö, Sverige	Boda byväg 2B, 139 90 Värmdö, Sverige

Let’s get connecting!

Let’s get connecting!

I can haz standard?

- (e)obd-(II)
- Regulates network protocol and connector
- semi compulsory list of queries
- Engine and maintenance information

I can haz standard?

PID (hex)	Data bytes returned	Description
0	4	PIDs supported [01 - 20]
1	4	Monitor status since DTCs cleared. (Includes malfunction indicator lamp (MIL) status and number of DTCs.)
2	2	Freeze DTC
3	2	Fuel system status
4	1	Calculated engine load
5	1	Engine coolant temperature
6	1	Short term fuel trim—Bank 1
7	1	Long term fuel trim—Bank 1
8	1	Short term fuel trim—Bank 2
9	1	Long term fuel trim—Bank 2
0A	1	Fuel pressure
0B	1	Intake manifold absolute pressure
0C	2	Engine RPM
0D	1	Vehicle speed
0E	1	Timing advance
0F	1	Intake air temperature
10	2	MAF air flow rate
11	1	Throttle position
12	1	Commanded secondary air status
13	1	Oxygen sensors present (in 2 banks)
14	2	Oxygen Sensor 1 A: Voltage B: Short term fuel trim
15	2	Oxygen Sensor 2 A: Voltage B: Short term fuel trim
16	2	Oxygen Sensor 3 A: Voltage B: Short term fuel trim
17	2	Oxygen Sensor 4 A: Voltage B: Short term fuel trim
18	2	Oxygen Sensor 5 A: Voltage B: Short term fuel trim
19	2	Oxygen Sensor 6 A: Voltage B: Short term fuel trim

PID (hex)	Data bytes returned	Description
1A	2	Oxygen Sensor 7 A: Voltage B: Short term fuel trim
1B	2	Oxygen Sensor 8 A: Voltage B: Short term fuel trim
1C	1	OBD standards this vehicle conforms to
1D	1	Oxygen sensors present (in 4 banks)
1E	1	Auxiliary input status
1F	2	Run time since engine start
20	4	PIDs supported [21 - 40]
21	2	Distance traveled with malfunction indicator lamp (MIL) on
22	2	Fuel Rail Pressure (relative to manifold vacuum)
23	2	Fuel Rail Gauge Pressure (diesel, or gasoline direct injection)
24	4	Oxygen Sensor 1 AB: Fuel–Air Equivalence Ratio CD: Voltage
25	4	Oxygen Sensor 2 AB: Fuel–Air Equivalence Ratio CD: Voltage
26	4	Oxygen Sensor 3 AB: Fuel–Air Equivalence Ratio CD: Voltage
27	4	Oxygen Sensor 4 AB: Fuel–Air Equivalence Ratio CD: Voltage
28	4	Oxygen Sensor 5 AB: Fuel–Air Equivalence Ratio CD: Voltage
29	4	Oxygen Sensor 6 AB: Fuel–Air Equivalence Ratio CD: Voltage
2A	4	Oxygen Sensor 7 AB: Fuel–Air Equivalence Ratio CD: Voltage
2B	4	Oxygen Sensor 8 AB: Fuel–Air Equivalence Ratio CD: Voltage
2C	1	Commanded EGR
2D	1	EGR Error
2E	1	Commanded evaporative purge
2F	1	Fuel Tank Level Input

PID (hex)	Data bytes returned	Description
30	1	Warm-ups since codes cleared
31	2	Distance traveled since codes cleared
32	2	Evap. System Vapor Pressure
33	1	Absolute Barometric Pressure
34	4	Oxygen Sensor 1 AB: Fuel–Air Equivalence Ratio CD: Current
35	4	Oxygen Sensor 2 AB: Fuel–Air Equivalence Ratio CD: Current
36	4	Oxygen Sensor 3 AB: Fuel–Air Equivalence Ratio CD: Current
37	4	Oxygen Sensor 4 AB: Fuel–Air Equivalence Ratio CD: Current
38	4	Oxygen Sensor 5 AB: Fuel–Air Equivalence Ratio CD: Current
39	4	Oxygen Sensor 6 AB: Fuel–Air Equivalence Ratio CD: Current
3A	4	Oxygen Sensor 7 AB: Fuel–Air Equivalence Ratio CD: Current
3B	4	Oxygen Sensor 8 AB: Fuel–Air Equivalence Ratio CD: Current
3C	2	Catalyst Temperature: Bank 1, Sensor 1
3D	2	Catalyst Temperature: Bank 2, Sensor 1
3E	2	Catalyst Temperature: Bank 1, Sensor 2
3F	2	Catalyst Temperature: Bank 2, Sensor 2
40	4	PIDs supported [41 - 60]
41	4	Monitor status this drive cycle
42	2	Control module voltage
43	2	Absolute load value
44	2	Fuel–Air commanded equivalence ratio
45	1	Relative throttle position
46	1	Ambient air temperature
47	1	Absolute throttle position B
48	1	Absolute throttle position C

PID (hex)	Data bytes returned	Description
49	1	Accelerator pedal position D
4A	1	Accelerator pedal position E
4B	1	Accelerator pedal position F
4C	1	Commanded throttle actuator
4D	2	Time run with MIL on
4E	2	Time since trouble codes cleared
4F	4	Maximum value for Fuel–Air equivalence ratio, oxygen sensor voltage, oxygen sensor current, and intake manifold absolute pressure
50	4	Maximum value for air flow rate from mass air flow sensor
51	1	Fuel Type
52	1	Ethanol fuel %
53	2	Absolute Evap system Vapor Pressure
54	2	Evap system vapor pressure
55	2	Short term secondary oxygen sensor trim, A: bank 1, B: bank 3
56	2	Long term secondary oxygen sensor trim, A: bank 1, B: bank 3
57	2	Short term secondary oxygen sensor trim, A: bank 2, B: bank 4
58	2	Long term secondary oxygen sensor trim, A: bank 2, B: bank 4
59	2	Fuel rail absolute pressure
5A	1	Relative accelerator pedal position
5B	1	Hybrid battery pack remaining life
5C	1	Engine oil temperature
5D	2	Fuel injection timing
5E	2	Engine fuel rate
5F	1	Emission requirements to which vehicle is designed
60	4	PIDs supported [61 - 80]
61	1	Driver's demand engine - percent torque
62	1	Actual engine - percent torque
63	2	Engine reference torque
64	5	Engine percent torque data
65	2	Auxiliary input / output supported
66	5	Mass air flow sensor
67	3	Engine coolant temperature
68	7	Intake air temperature sensor
69	7	Commanded EGR and EGR Error
6A	5	Commanded Diesel intake air flow control and relative intake air flow position
6B	5	Exhaust gas recirculation temperature

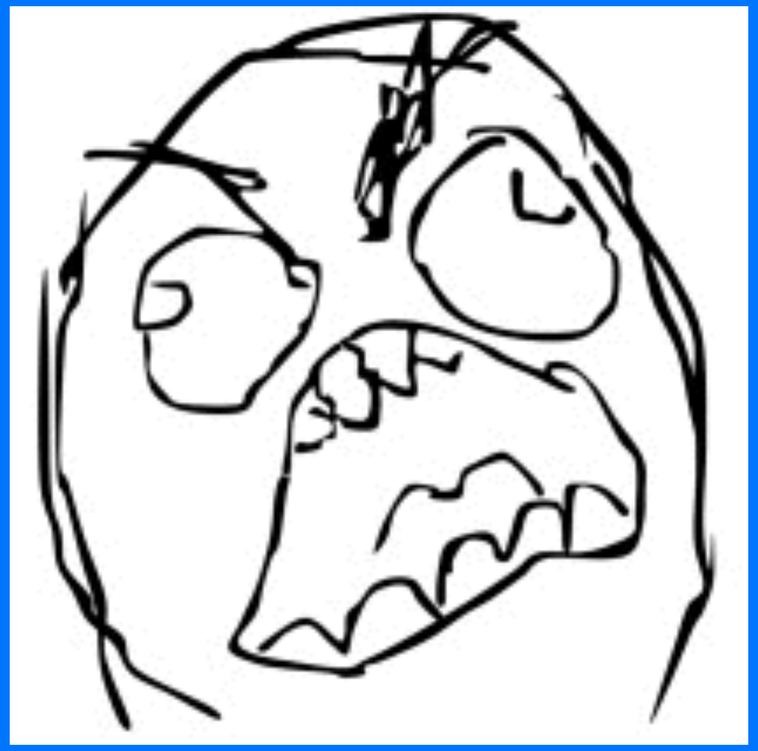
PID (hex)	Data bytes returned	Description
6C	5	Commanded throttle actuator control and relative throttle position
6D	6	Fuel pressure control system
6E	5	Injection pressure control system
6F	3	Turbocharger compressor inlet pressure
70	9	Boost pressure control
71	5	Variable Geometry turbo (VGT) control
72	5	Wastegate control
73	5	Exhaust pressure
74	5	Turbocharger RPM
75	7	Turbocharger temperature
76	7	Turbocharger temperature
77	5	Charge air cooler temperature (CACT)
78	9	Exhaust Gas temperature (EGT) Bank 1
79	9	Exhaust Gas temperature (EGT) Bank 2
7A	7	Diesel particulate filter (DPF)
7B	7	Diesel particulate filter (DPF)
7C	9	Diesel Particulate filter (DPF) temperature
7D	1	NOx NTE control area status
7E	1	PM NTE control area status
7F	13	Engine run time
80	4	PIDs supported [81 - A0]
81	21	Engine run time for Auxiliary Emissions Control Device(AECD)
82	21	Engine run time for Auxiliary Emissions Control Device(AECD)
83	5	NOx sensor
84		Manifold surface temperature
85		NOx reagent system
86		Particulate matter (PM) sensor
87		Intake manifold absolute pressure

(e)obd compliance

(e)obd compliance

00	01	02	03	04	05	06	07	08	09	0a	0b	0c	0d	0e	0f
10	11	12	13	14	15	16	17	18	19	1a	1b	1c	1d	1e	1f
20	21	22	23	24	25	26	27	28	29	2a	2b	2c	2d	2e	2f
30	31	32	33	34	35	36	37	38	39	3a	3b	3c	3d	3e	3f
40	41	42	43	44	45	46	47	48	49	4a	4b	4c	4d	4e	4f
50	51	52	53	54	55	56	57	58	59	5a	5b	5c	5d	5e	5f
60	61	62	63	64	65	66	67	68	69	6a	6b	6c	6d	6e	6f
70	71	72	73	74	75	76	77	78	79	7a	7b	7c	7d	7e	7f
80	81	82	83	84	85	86	87	88	89	8a	8b	8c	8d	8e	8f

(e)obd compliance



What to do?

What to do?

- Target a specific vehicle

What to do?

- Target a specific vehicle
- Use common features

What to do?

- Target a specific vehicle
- Use common features
- Bring your own features

+

Back to our example

- ~~Target a specific vehicle~~
- Use common features
- Bring your own features

+

Back to our example

- ~~Target a specific vehicle~~
- Use common features
- Bring your own features

+

Back to our example

- ~~Target a specific vehicle~~
- Use common features
- Bring your own features

Where to go next?

Where to go next?

Target a specific vehicle vs. B.Y.O.F / Common features

Where to go next?

Identify vehicle vs. B.Y.O.F / Common features

Thank you