

EPICS Web Services

at the Canadian Light Source

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Controls & Instrumentation Group

EPICS Collaboration Meeting - ITER

June 2019



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Web Services Definition

- machine to machine communication via WWW
- web protocols: e.g., http, https, etc.
- response: XML, JSON, etc.



REST (Representational State Transfer) APIs

- architectural style for **web services** (RESTful APIs)
- uniform, predictable URIs
- stateless
- scalable
- standard HTTP methods (GET, POST, etc.)

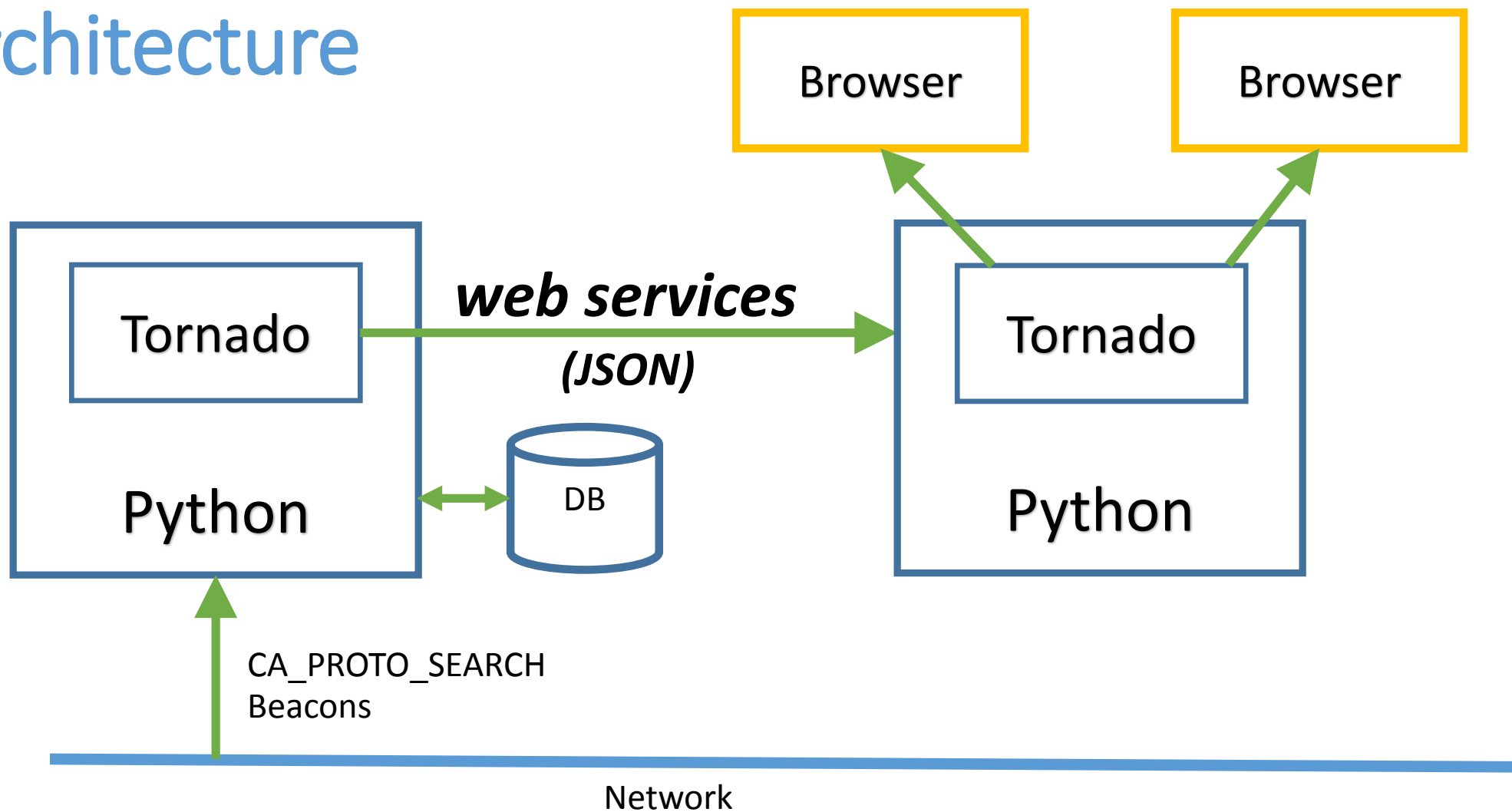


RESTful EPICS *Web Services* at the CLS

- There are some, but...
- Very rudimentary (i.e., prototype level)
- We are here to learn



Architecture



CLS RESTful APIs

`https://epicsgateway.clsi.ca`

`/get_pv/<pv_name>`

`/list_pvs`

`/list_iocs`

`/list_clients`

`/list_requests`

`/list_beacons`



CLS RESTful APIs

`/list_pvs`

`/list_pvs/?count=<X>&offset=<Y>`

`/list_pvs/?count=<X>&offset=<Y>&sort=<mode>`

`/list_pvs/?count=<X>&offset=<Y>&search=<regex>`

`/list_pvs/?count=<X>&offset=<Y>&ioc=<id>`

`/list_pvs/?count=<X>&offset=<Y>&app=<id>`

`/list_pvs/?count=<X>&offset=<Y>&invalid`

`/list_pvs/?count=<X>&offset=<Y>&duplicate`

`/list_pvs/?count=<X>&offset=<Y>&ioc=<id>&search=<regex>&sort=<mode>`



Example: PV Monitor

- **List EPICS PVs**
 - all / host / IOC / applications
 - lost / duplicate / invalid names
 - most requested
 - search
- **List EPICS IOCS**
 - apps / beacons / PVs
- **List Requesting Clients**



Displaying 1 - 25 of 659815 detected PVs

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Index	PV Name	Requests (Tot.)	Requests (Non GW)	Last	Server	Port	Lost
1	SMTR1607-7-I21-03:veloBase	113220	84	NBK-W001627	IOC1607-008	43683	
2	IOP1302-03:ChannellInfo:cycle:upd2	9259	0		IOC2401-101	1039	
3	SYM1411-14:cAbsStep	32878	9	NBK-W001627	IOC2408-306	42765	
4	SMTR1607-5-I10-17:servo:pid:integrationSumLimit	151319	47	NBK-W001627	IOC1607-007	38528	
5	SMTR1607-8-I10-21:calibMove2	124533	13193	VMIOC2400-106	IOC1607-007	38528	
6	SMTR1601-1-R10-56:cosineOn	67336	13	NBK-W001627	IOC1601-103	34576	
7	CCG0004-01:vac:raw	72560	188	VM-ARCHIVER-02	VIOC2400-110	53477	
8	BID1411-03:A:osc	5377915	134560	OPI1021-101			
9	SMTR1604-3-I22-27:debugLevel	25970	46	WKS-W001434.	OPI1604-002	5064	** LOST **
10	IOP1302-03:reset	68666	15	WKS-W001434.	IOC2401-101	1027	** LOST **
11	SMTR1601-1-R10-63:debugLevel	50809	7	NBK-W001627	IOC1601-103	34576	
12	dxp1607-B21-13:dxp3:EnergyThreshold	59935	243	OPI1607-002	Unknown (10.52.27.242)	3184	** LOST **
13	SMTR1610-4-I22-09:preDBand	78463	617	OPI1610-204	IOC1610-025	34964	
14	07B2_YSL_U:ExtPVDL	60626	19	NBK-W001627	IOC1607-003	32805	
15	IOP1409-B20-02	90834	531	VM-ARCHIVER-02	VIOC2400-110	47686	
16	IOP1409-B20-03	96006	457	VM-ARCHIVER-02	VIOC2400-110	47686	
17	IOP1409-B20-04	94956	633	VM-ARCHIVER-02	VIOC2400-110	47686	
18	IOP1409-B20-05	94641	443	VM-ARCHIVER-02	VIOC2400-110	47686	
19	SMTR1607-8-I10-21:calibMove1	122489	13199	VMIOC2400-106	IOC1607-007	38528	
20	SMTR1607-7-I21-13:softLimit:configure	68811	13	WKS-W001434.	IOC1607-008	43683	
21	ENC1607-5-I10-21:atBoot	67541	5	NBK-W001627	IOC1607-007	48201	
22	DO4611	9498	7	WKS-W001434.	OPI2017-001	5064	** LOST **
23	MSD1606-5-07:intvl:fbk	56084	68	OPI1606-601	IOC1606-022	48014	
24	SMTR1608-4-B10-26:backlash	215154	37499	VMIOC2400-106	IOC1608-021	5064	
25	SMTR0000-E09-01:brakeBit	99590	43	NBK-W001627	IOC0000-E09-02	5064	** LOST **

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SMTR1411-22:brakeBit

00000000: 53 4D 54 52 31 34 31 31 2D 32 32 3A 62 72 61 6B SMTR1411-22:brak
00000010: 65 42 69 74 eBit

Most Recent Client Requests:

Time	Host	Port	Count
2018-10-22 14:24:04	NBK-W001627	63999	2
2018-10-18 17:03:11	NBK-W001627	62007	1
2018-07-13 14:17:49	OPI1504-103	36739	1
2018-07-09 13:59:59	OPI1504-103	60743	6
2018-06-26 11:33:53	OPI0000-001	38784	1
2018-06-22 17:10:01	OPI2031-005	53279	3
2018-04-05 16:00:43	OPI1504-103	35333	1
2018-03-27 15:17:05	OPI1504-103	51494	685
2018-03-23 16:20:43	OPI2031-005	56045	13
2018-02-28 12:55:39	OPI2031-005	60306	1

40387 Gateway Requests - Latest: 2019-05-27 20:21:15

[Update Server Info](#)

First Time	Last Time	Host	Port
2019-03-21 17:51:19	2019-05-27 20:21:17	IOC2408-306	42765
2018-10-29 20:19:19	2019-03-20 05:11:40	Not Found	
2018-10-31 05:14:55	2019-03-03 23:21:35	IOC2408-306	46296
2018-07-21 10:12:08	2018-10-29 03:51:04	IOC2408-306	43323
2018-04-17 02:04:28	2018-07-20 02:58:21	IOC2408-306	33457

[CAINFO](#)

[Heartbeat](#)

Command Files

/iocApps/InsertionDevices/IOC2408-306/PGM_EpuMotors/st.cmd

Detected 33 Duplicate PVs

PV Name	Server 1	Server 2	More?
AMP1504-01:frequency:fbk	IOC1504-001 (1031)	IOC1504-001 (1026)	
AMP1504-01:magnitude:fbk	IOC1504-001 (1031)	IOC1504-001 (1026)	
AMP1504-01:phase:fbk	IOC1504-001 (1031)	IOC1504-001 (1026)	
booster:vac	VIOC2400-110 (46651)	VIOC2400-110 (53477)	
CV2608-1101	VMIOC2400-105 (32851)	VIOC2400-110 (37998)	
IOCSR_0_Name	IOC1610-303 (49549)	IOC2031-001 (1054)	
IOCSR_0_State	IOC1610-303 (49549)	IOC1610-303 (5064)	2 more
IOCSR_0_Status	IOC1610-303 (49549)	IOC1610-303 (5064)	2 more
IOCSR_0_StatusStr	IOC1610-303 (49549)	IOC2031-001 (1054)	
IOCSR_0_Time	IOC1610-303 (49549)	IOC1610-303 (5064)	2 more
IOCSR_heartbeat	IOC1610-303 (49549)	IOC1610-303 (5064)	2 more
IOCSR_rebootStatus	IOC1610-303 (49549)	IOC2031-001 (1054)	
IOCSR_rebootStatusStr	IOC1610-303 (49549)	IOC1610-303 (5064)	2 more
IOCSR_rebootTime	IOC1610-303 (49549)	IOC1610-303 (5064)	2 more
IOCSR_recentlyStr	IOC1610-303 (49549)	IOC1610-303 (5064)	2 more
IOCSR_status	IOC1610-303 (49549)	IOC1610-303 (5064)	2 more
IOCSR_statusStr	IOC1610-303 (49549)	IOC1610-303 (5064)	2 more
IOP1032-02:current	VIOC2400-110 (57164)	IOC1032-001 (1025)	
IOP1032-04:current	VIOC2400-110 (57164)	IOC1032-001 (1025)	
IOP1032-06:current	VIOC2400-110 (57164)	IOC1032-001 (1025)	
IOP1032-08:current	VIOC2400-110 (57164)	IOC1032-002 (1025)	
IOP1032-10:current	VIOC2400-110 (57164)	IOC1032-002 (1025)	
IOP1032-12:current	VIOC2400-110 (57164)	IOC1032-002 (1025)	



Displaying 1 - 25 of 4792 Invalid PV Names

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Index	PV Name	Requests	Last
1		30	OPI1611-408
2	.DESC	30	OPI1611-408
3	PCT1402-01:mA:fbk ...	8	OPI1013-102
4	PCT1402-01:mA:fbk ...	8	OPI1013-102
5	PCT1402-01:mA:fbk	39	OPI1610-001
6	PCT1402-01:mA:fbk.DESC	39	OPI1610-001
7	GP1400-01:Rate Filtered	190	VOPIREMOTE-01
8	GP1400-01:Rate Filtered.DESC	190	VOPIREMOTE-01
9	not found. Channel connect timed out: c...	8	OPI2049-002
10	QERadioGroup .DESC	4	WKS-W001991.
11	"GP00S1-01:Rate_Filtered"	5558	WKS-W001434.
12	"GP00S1-01:signal_egu"	5612	WKS-W001434.
13	"NP00S1-01:Rate_Filtered"	5522	WKS-W001434.
14	"NP00S1-01:signal_egu"	5522	WKS-W001434.
15	#	185	OPI2017-001
16	# M10:calibDone	75	IOC1601-103
17	# M10:calibRun	75	IOC1601-103
18	# M4 motors:calibDone	82	IOC1601-103
19	# M4 motors:calibRun	82	IOC1601-103
20	# M5 motors:calibDone	82	IOC1601-103
21	# M5 motors:calibRun	82	IOC1601-103
22	# M6 motors:calibDone	82	IOC1601-103
23	# M6 motors:calibRun	82	IOC1601-103
24	# M7 motors:calibDone	64	IOC1601-103
25	# M7 motors:calibRun	64	IOC1601-103

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Status of IOC: IOC1606-201 (10.52.36.20)

State: **ACTIVE**

[Set State: MAINTENANCE](#)

[Set State: TEST/DEVELOPMENT](#)

[Set State: DECOMMISSIONED](#)

[Detected PVs](#) [procServ Processes](#) [LinuxMonitor](#)

procServ Processes Detected

Telnet Port	Command
10001	/home/epics/src/R3.14.12/local/bin/linux-armv5teb/procServ -c /iocApps/06ID_HXMA/IOC1606-201 --noautorestart --allow --network 10.5
10004	/home/epics/src/R3.14.12/local/bin/linux-armv5teb/procServ -c /iocApps/06ID_HXMA/IOC1606-201 --noautorestart --allow --network 10.5
10005	/home/epics/src/R3.14.12/local/bin/linux-armv5teb/procServ -c /iocApps/06ID_HXMA/IOC1606-201/LakeShore331 --noautorestart --allow
10100	/home/epics/bin/linux-armv5teb/procServ -c /iocApps/LinuxMonitor/current/ --noautorestart --allow --network 10.0.0.0/8 10100 /bin/sh Li

4 EPICS Beacons Detected on 4 TCP Ports (Expect 4):

TCP Port	Command	Directory
1025	./bin/linux-armv5teb/LakeShore331 st.cmd	/iocApps/06ID_HXMA/IOC1606-201/LakeShore331
1026	bin/linux-armv5teb/SR570 st.cmd-ioc1606-201	/iocApps/06ID_HXMA/IOC1606-201
1028	./bin/linux-armv5teb/LinuxMonitor st.cmd	/iocApps/LinuxMonitor/v12/LinuxMonitor.20190116
5064	bin/linux-armv5teb/HSC st.cmd-hsc	/iocApps/06ID_HXMA/IOC1606-201

1 Heartbeat Detected

Index	TCP Port	PVs	Uptime	Forget
1	1028	43	125 days, 6:55:31	X



All IOCs 519 IOCS (with 1162 EPICS server apps)

All IOCs

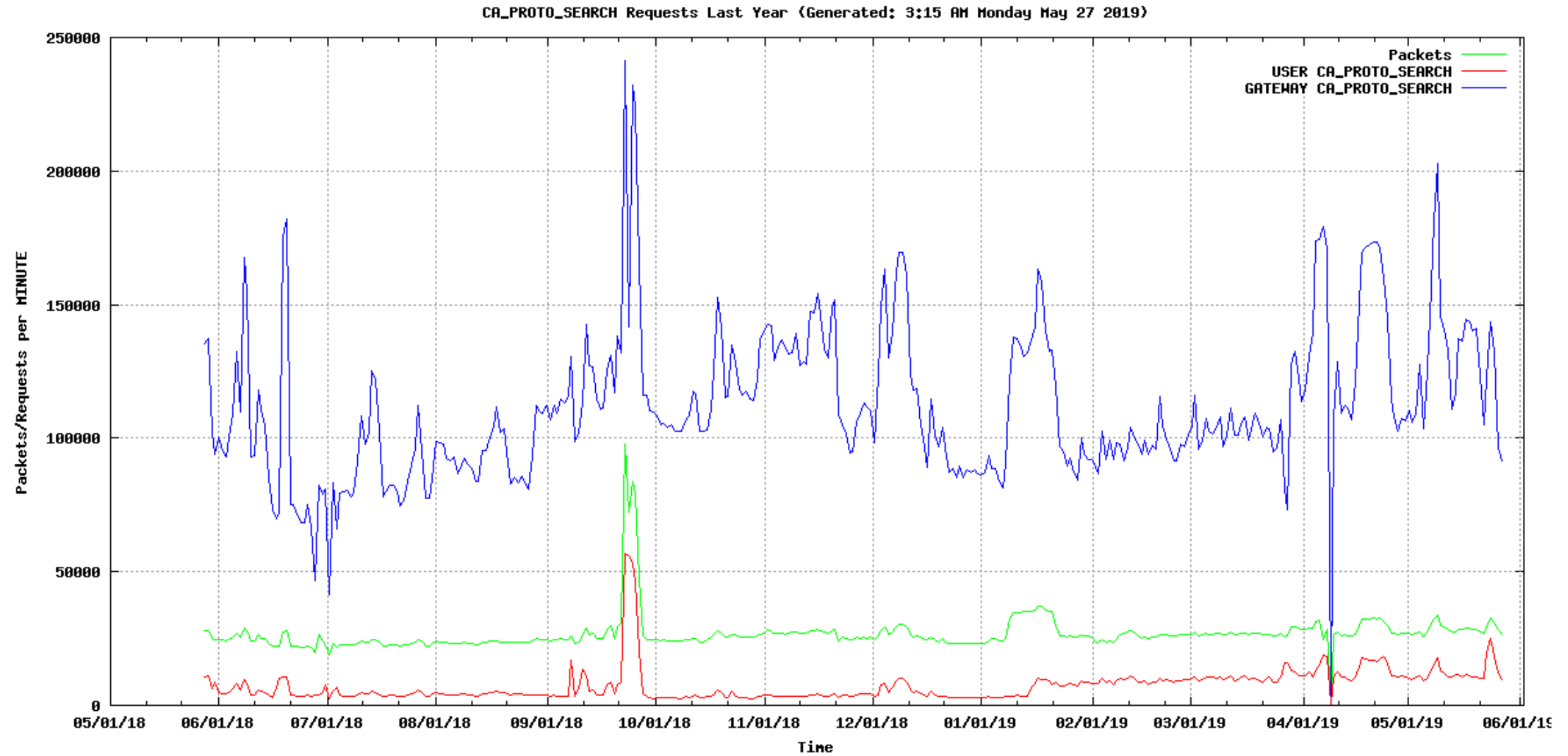


ACQ1001-322 (1)	ACQ1001-340 (1)	ACQ1001-341 (1)	ACQ1001-342 (1)	aca1001_343 (1)	aca1001_344 (1)	aca1001_345 (1)	aca1001_346 (1)	ADC2017-001 (1)	ADC2404-101 (1)
BPML2401-101 (1)	BPML2401-102 (1)	BPML2401-103 (1)	BPML2401-104 (1)	BPML2401-105 (1)	BPML2403-102 (1)	BPML2403-103 (1)	BPML2403-105 (1)	BPML2403-107 (1)	BPML2405-201 (1)
BPML2406-303 (1)	BPML2408-101 (1)	BPML2408-102 (1)	BPML2408-102a (1)	CCDC1608-004 (1)	CLS-00-90-e8-0c-10-07 (1)	CLS-00-90-e8-29-43-7d (1)	CLS-00-d0-50-31-11-75 (1)	CLS-f8-b1-56-de-42-50 (1)	DMS1606-601 (1)
IOC0000-003 (1)	IOC0000-015 (2)	IOC0000-031 (1)	IOC0000-046 (1)	IOC0000-051 (3)	IOC0000-07 (3)	IOC0000-E01-01 (2)	IOC0000-E03-01 (3)	IOC0000-E09-01 (2)	IOC0000-E11-401 (1)
IOC0004-007 (4)	IOC0004-008 (3)	IOC0004-104 (1)	IOC0006-102b (1)	IOC0006-105 (2)	IOC0009-001 (1)	IOC0009-201 (1)	IOC0009-202 (2)	IOC0013-001 (2)	IOC0102-102 (4)
IOC0102-404 (4)	IOC0102-405 (3)	IOC0105-602 (2)	IOC1009-109 (1)	IOC1009-109 (1)	IOC1021-201 (3)	IOC1021-504 (3)	IOC1022-101 (1)	IOC1022-102 (1)	IOC1022-103 (1)
IOC1029-001 (2)	IOC1032-001 (5)	IOC1032-002 (5)	IOC1066-003 (1)	IOC1104-101 (2)	IOC1104-102 (8)	IOC1104-104 (2)	IOC1126-002 (3)	IOC1126-004 (1)	IOC1126-004 (1)
IOC1126-007 (9)	IOC1126-008 (2)	IOC1126-011 (1)	IOC1406-001 (2)	IOC1406-002 (2)	IOC1408-001 (2)	IOC1408-002 (2)	IOC1500-101 (3)	IOC1503-001 (2)	IOC1503-002 (2)
IOC1601-101 (5)	IOC1601-103 (6)	IOC1602-101 (7)	IOC1602-102 (2)	IOC1602-104 (4)	IOC1604-001 (3)	IOC1604-002 (2)	IOC1606-001 (2)	IOC1606-004 (5)	IOC1606-010 (1)
IOC1606-013 (1)	IOC1606-014 (14)	IOC1606-015 (3)	IOC1606-018 (2)	IOC1606-019 (1)	IOC1606-022 (8)	IOC1606-025 (2)	IOC1606-201 (4)	IOC1606-207 (4)	IOC1606-208 (2)
IOC1606-401 (2)	IOC1606-501 (2)	IOC1606-503 (1)	IOC1606-504 (1)	IOC1606-505 (2)	IOC1606-506 (2)	IOC1606-507 (1)	IOC1606-601 (2)	IOC1606-602 (2)	IOC1607-001 (2)
IOC1607-005 (1)	IOC1607-007 (14)	IOC1607-008 (12)	IOC1607-009 (9)	IOC1607-010 (2)	IOC1607-011 (1)	IOC1607-012 (1)	IOC1607-102 (4)	IOC1607-203 (6)	IOC1607-501 (2)
IOC1607-702 (4)	IOC1607-801 (4)	IOC1607-803 (1)	IOC1607-804 (1)	IOC1608-001 (4)	IOC1608-004 (3)	IOC1608-008 (13)	IOC1608-009 (1)	IOC1608-010 (1)	IOC1608-011 (1)
IOC1608-021 (11)	IOC1608-022 (2)	IOC1608-023 (1)	IOC1608-025 (2)	IOC1608-026 (1)	IOC1608-027 (1)	IOC1608-1001 (3)	IOC1608-301 (8)	IOC1608-302 (7)	IOC1608-304 (1)
IOC1608-504 (1)	IOC1608-901 (4)	IOC1609-002 (2)	IOC1609-003 (3)	IOC1609-004 (2)	IOC1609-005 (3)	IOC1609-101 (4)	IOC1610-001 (4)	IOC1610-002 (3)	IOC1610-003 (2)
IOC1610-021 (1)	IOC1610-022 (2)	IOC1610-025 (1)	IOC1610-101 (3)	IOC1610-105 (4)	IOC1610-108 (2)	IOC1610-201 (3)	IOC1610-201b (1)	IOC1610-301 (1)	IOC1610-302 (1)
IOC1610-403 (1)	IOC1610-404 (1)	IOC1611-002 (3)	IOC1611-101 (6)	IOC1611-103 (2)	IOC1611-401 (1)	IOC1611-403 (1)	IOC1611-404 (1)	IOC1611-405 (1)	IOC1611-407 (1)
IOC1611-413 (3)	IOC1611-423 (1)	IOC1611-424 (1)	IOC1611-425 (1)	IOC1611-426 (1)	IOC1611-427 (8)	IOC1611-428 (8)	IOC1611-433 (2)	IOC1611-435 (1)	IOC1611-436 (2)
IOC1611-439 (4)	IOC1611-441 (2)	IOC1611-442 (2)	IOC1611-443 (2)	IOC1611-444 (7)	IOC1611-445 (2)	IOC2001-002 (2)	IOC2015-001 (3)	IOC2022-001 (1)	IOC2023-003 (1)
IOC2031-001 (3)	IOC2031-102 (1)	IOC2031-103 (1)	IOC2049-001 (1)	IOC2400-002 (2)	IOC2400-104 (1)	IOC2400-112 (2)	IOC2401-101 (5)	IOC2402-101 (3)	IOC2402-104 (2)
IOC2403-101 (3)	IOC2403-102 (4)	IOC2403-104 (1)	IOC2403-109 (2)	IOC2403-110 (2)	IOC2403-111 (2)	IOC2403-112 (3)	IOC2403-201 (2)	IOC2403-204 (3)	IOC2403-301 (4)

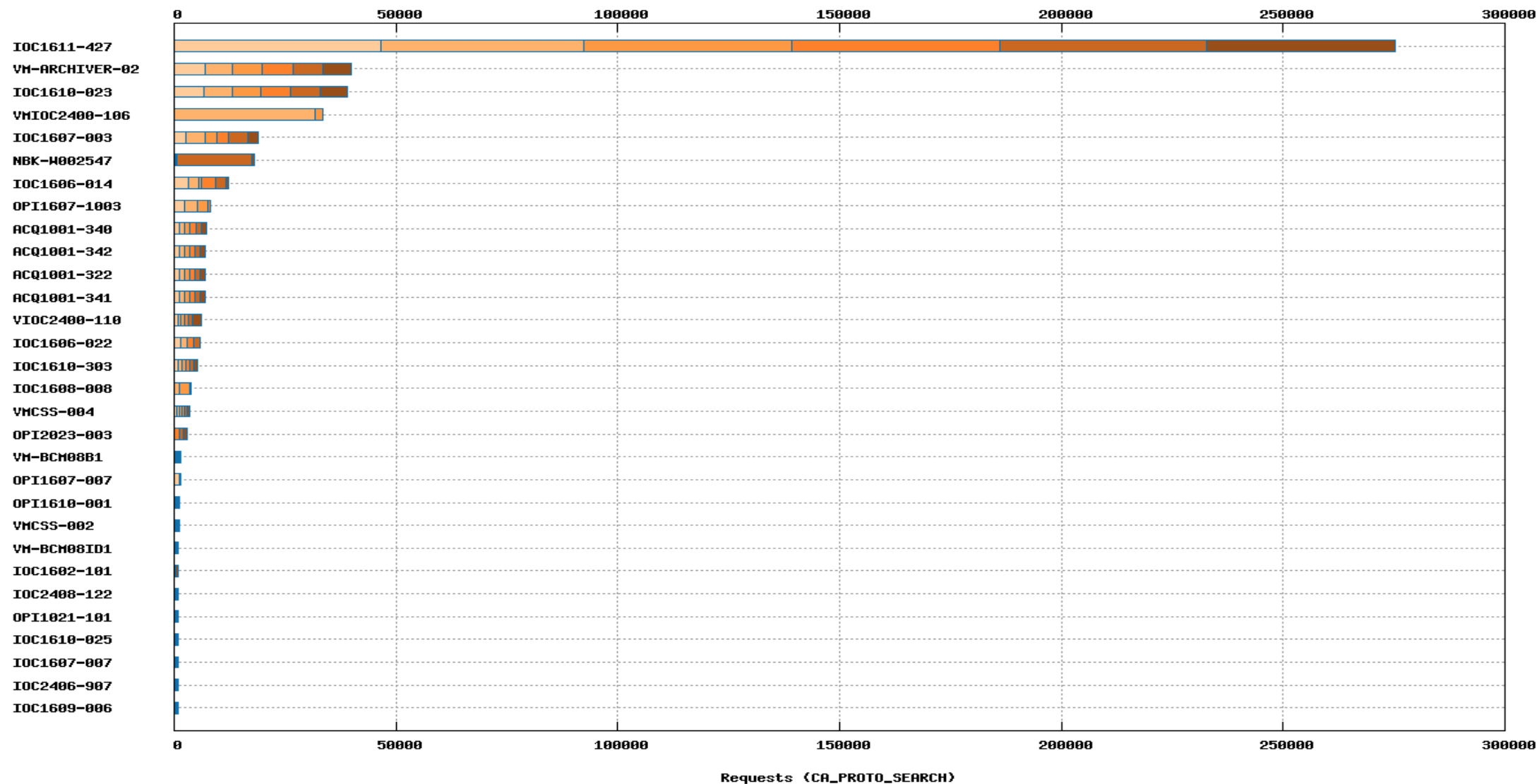


CA_PROTO_SEARCH - Last Year

[Hour](#) [Day](#) [Week](#) [Month](#) [Year](#) [Most requested PVs](#) [Latest requested PVs](#) [Latest requesting Clients](#)



Top Clients (CA_PROTO_SEARCH) Last Hour (Generated: 4:50 PM Tuesday May 28 2019)



Lessons Learned

- Enforces modularity
- Separates logic and presentation
- Legacy is difficult
- Develop with testability in mind

Possible Future Goals

- OAUTH
- API Keys (permissions & roles)
- More clients (not just PV Monitor)
- More APIs:
 - Archiver
 - Alarms & Notifications
 - Data Visualization?