


BESSY Channel Access Gateways

Overview


- TCP/IP Networking
- The Channel Access Protocol
- Channel Access Gateways
- CA Gateway Setup at BESSY
- The CA Gateway configuration repository

TCP/IP Networking: UDP and TCP

TCP




- Slower but more reliable transfers
- Typical Applications:
 - File Transfer Protocol (FTP)
 - Web Browsing
 - Email




unicast


UDP




- Faster but not guaranteed transfers ("best effort")
- Typical Applications:
 - Live Streaming
 - Online Games
 - VoIP



unicast

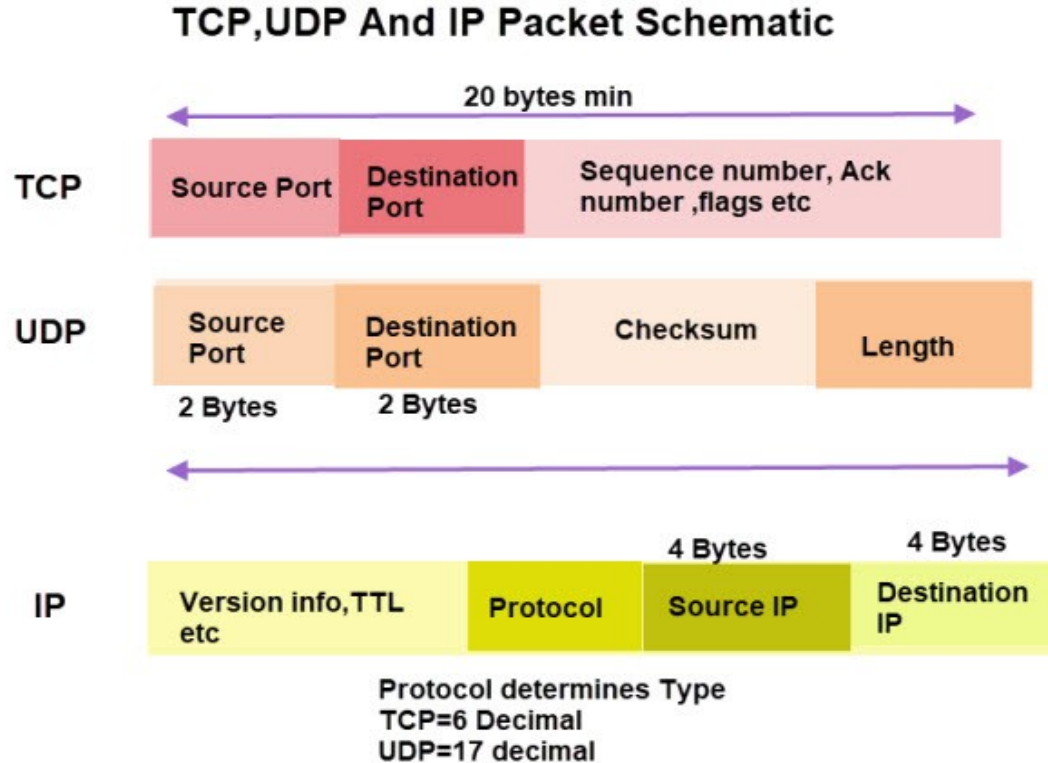


multicast



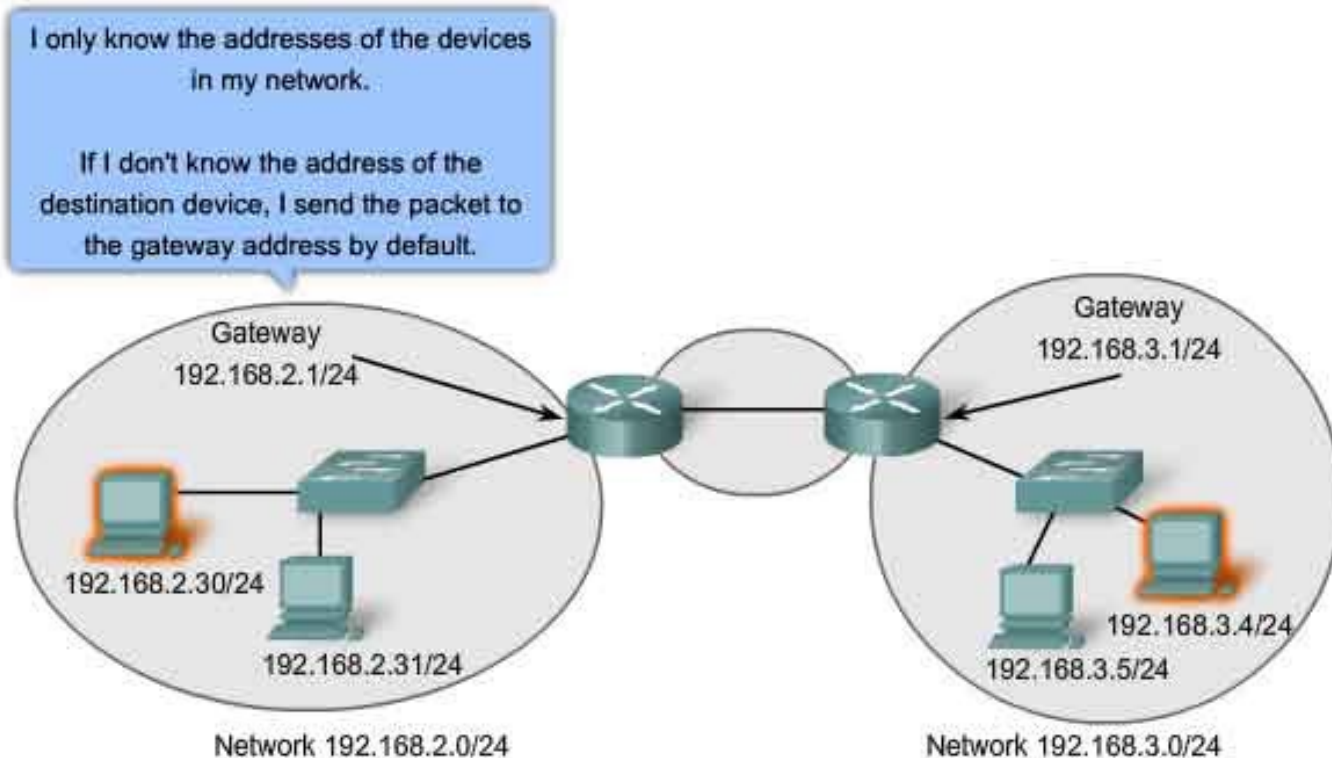
broadcast

TCP/IP Networking: Packages



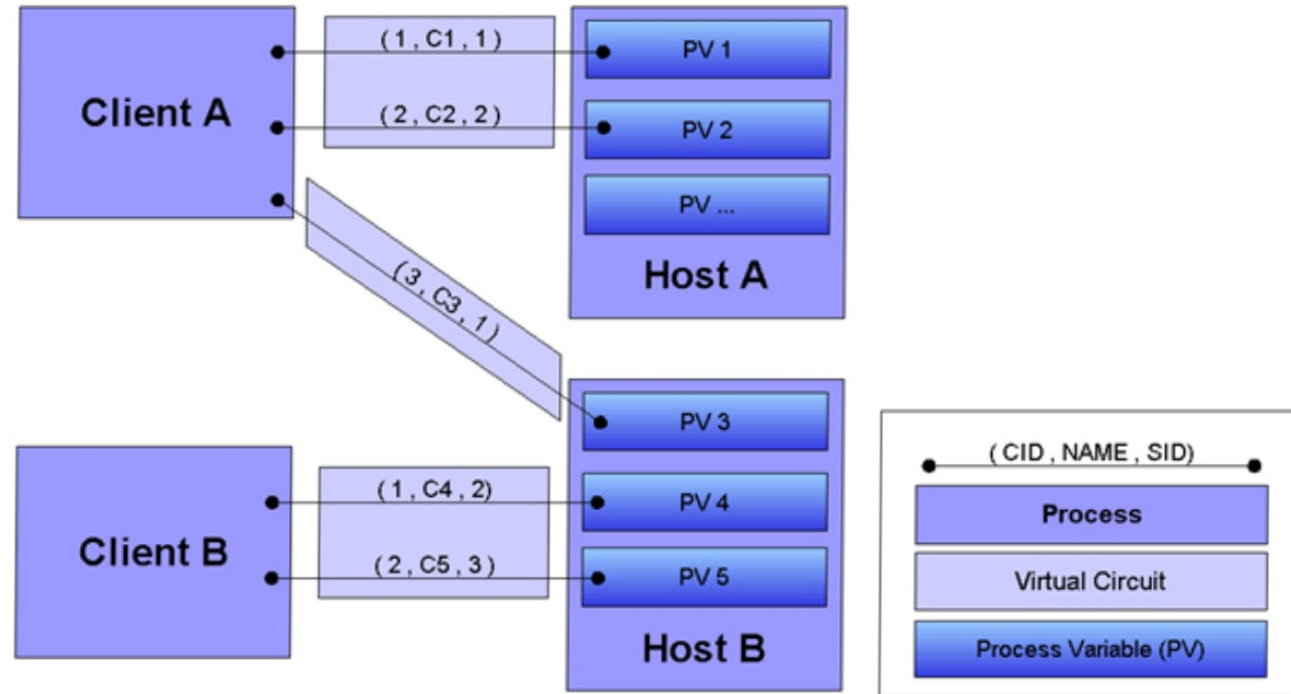
TCP/IP Networking: IP Gateways

Gateways Enable Communications between Networks



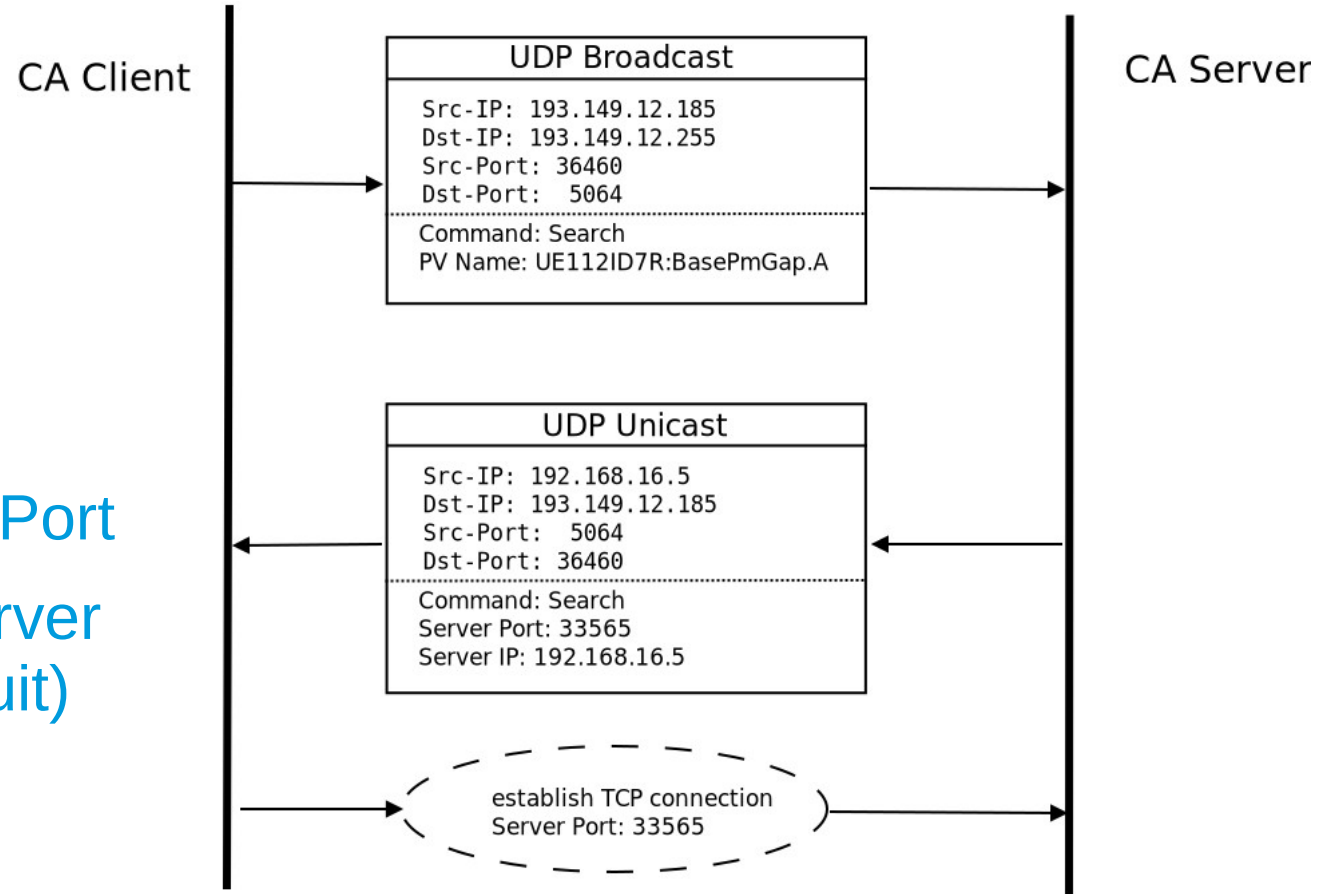
The Channel Access Protocol: Basics

- A Virtual Circuit is a TCP/IP connection between a client and a server
- The server for a PV is found by a Name Resolution Request



The Channel Access Protocol: Name Resolution

- Client sends UDP broadcast
- Waits until a server replies
- Server reply contains server-IP and server-Port
- Client connects to server with TCP (virtual circuit)

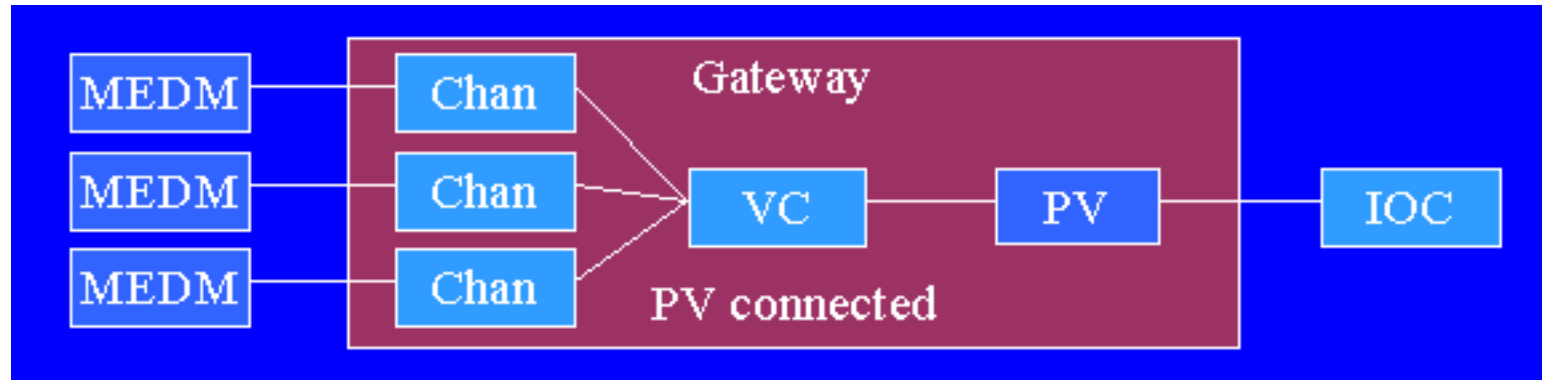


Channel Access Gateways: Properties

- One or more CA Servers
- One or more CA Clients
- Servers and Clients may have different IP-Address or IP-Port configuration
- Access Security configuration

Channel Access Gateways: Advantages

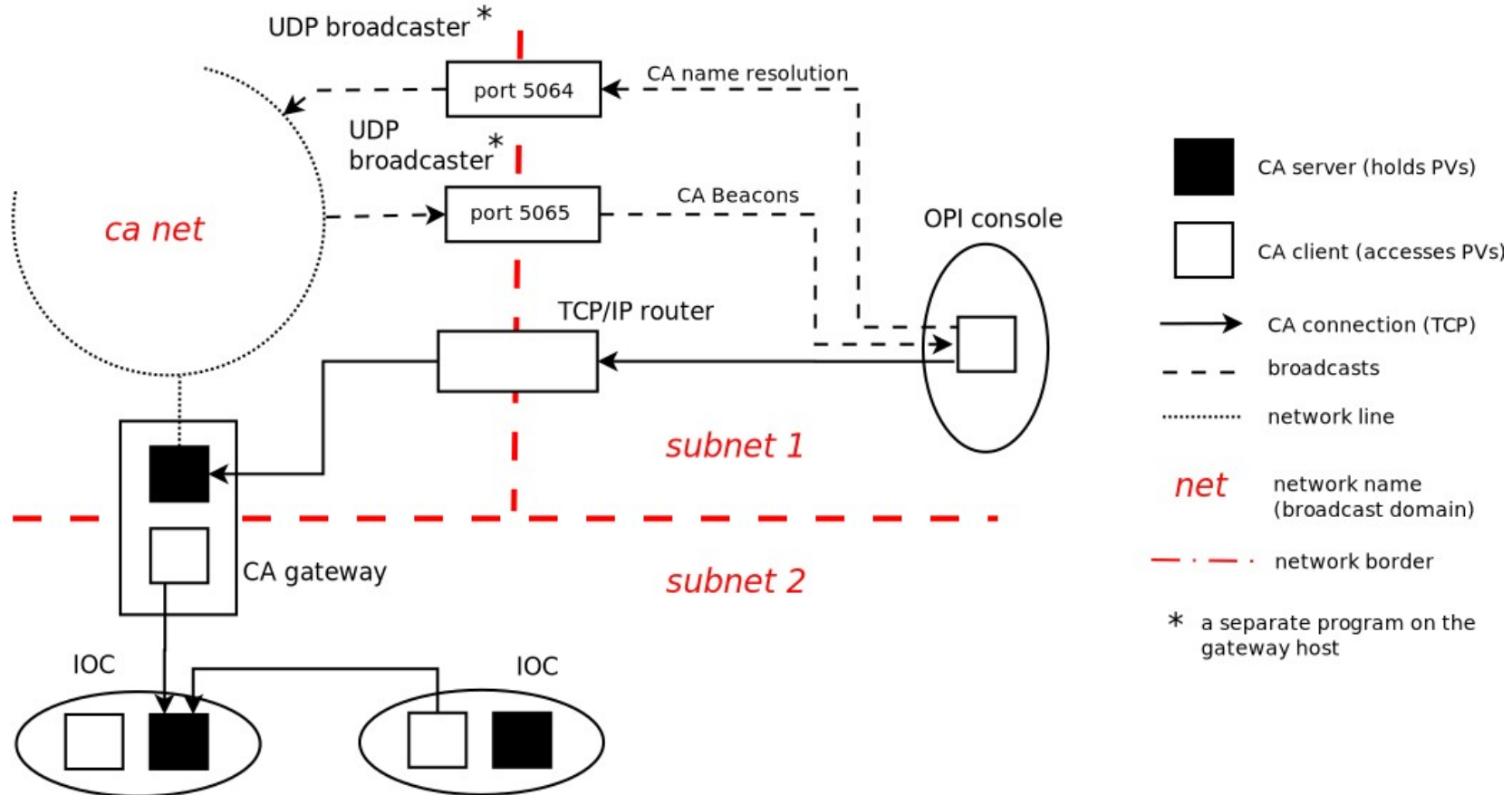
- Seamlessly connects networks of different broadcast domains
- Adds an extra layer of access security configuration
- Bundles traffic to and from IOCs



CA Gateway Setup at BESSY

- Standard Setup uses exporting gateways, one gateway exports Pvs from a subnet to all other networks
- All exporting gateways have their CA servers in a single central network, the „CA“ network
- UDP Broadcaster processes forward UDP broadcasts from subnets to the central CA network

CA Gateway Setup at BESSY



CA Gateway Setup at BESSY

- For BESSY our hardware consists of two gateway servers with a „trunk“ line. (Almost) all VLANs are on this line. The gateway servers have network interfaces for most networks.
- Almost all BESSY gateway processes as well as the UDP broadcaster processes run on a single machine, gwc1c.
- gwc2c can be used as a backup for gwc1c, but only after manually changing the configuration in file „params.json“.
- The MLS uses currently its old scheme of importing gateways but these are managed by the same configuration repository.

The CA Gateway configuration repository

- Mercurial Version Control
- Various helper scripts for easier maintainance
- JSON Configuration file
- Macro substitution with pyexpander. This helps to eliminate redundencies in configuration files.

The CA Gateway configuration repository

Example from the JSON configuration file

```
{
  ...
  "hosts": {
    "gwclc-ca.ca.bessy.de": {
      ...
      "blc-192-168-22-0-24": {
        "IP": {
          "BC_IGNORE": "192.168.22.6",
          "CA_BCAST": "192.168.16.255",
          "CA_IP": "192.168.16.5",
          "GW_EXTRA_ARGS": "-archive",
          "GW_IGNORE_SUBNET": true,
          "SUBNET_BCAST": "192.168.22.255",
          "SUBNET_IP": "192.168.22.5",
          "SUBNET_MASK": "255.255.255.0"
        },
        "services": [
          "cagateway",
          "udp-broadcaster-beacons",
          "udp-broadcaster-names"
        ]
      },
      ...
    },
    ...
  }
}
```

The CA Gateway configuration repository

Example from cagateway.access file

```
$include("gateways/common/access/blc.pyx")
$include("gateways/common/access/blc_alarm.pyx")
$include("gateways/common/access/opi.pyx")
$include("gateways/common/access/seg_bl_controls.pyx")
$include("gateways/common/access/undulators.pyx")
$include("gateways/common/access/mono.pyx")
$include("gateways/common/access/metrixs.pyx")
HAG(monotesting) {monoteststation}

$# create undulator access group IDADM_IDUSER_OPIADM_OPI
$# defined in common/access/undulators.pyx:
$IDADM_IDUSER_OPIADM_OPI(["metrixs"])

ASG(DEFAULT) {
    RULE(1, READ)
    RULE(1, WRITE, TRAPWRITE)
    {
        UAG(uag_blcadm)
        HAG(hag_blcadm)
    }
    RULE(1, WRITE, TRAPWRITE)
    {
        UAG(uag_alhadm)
        HAG(hag_alhadm)
    }
}
```

The CA Gateway configuration repository

Example from cagateway.pvlist file

```
EVALUATION ORDER ALLOW, DENY
```

```
.*                ALLOW
```

```
GW-.*:.*         ALLOW CAGW
```

```
GW-.*:report.Flag ALLOW CAGW_REPORTS
```

```
$include("gateways/common/pvlist/spam.pyx")
```

```
$include("gateways/common/pvlist/undulators.pyx")
```

```
$id_generic("IDADM_IDUSER_OPIADM_OPI", "IDADM_OPIADM_OPI")
```

```
#####
```

```
# components managed by group NP-ABS ELIS group
```

```
# The patterns were created to match all PVs from the files
```

```
# db/S06*.db from the BL_Controls project:
```

```
A[BL]S[VY]\(\|B\)[0-9]+.*06L:.*        ALLOW  SEG_BL_CONTROLS
```

```
BS[A-Z]*[0-9]+.*06L:.*                ALLOW  SEG_BL_CONTROLS
```

```
EXP[A-Z]*[0-9]+.*06L.*                 ALLOW  SEG_BL_CONTROLS
```

```
# Zugriff auf den U41PGM Monochromator vom Messplatz
```

```
u41lpgm1:Set.*                          ALLOW  U41EXP_MONO
```

```
u41lpgm1:ES.*                           ALLOW  U41EXP_MONO
```

```
u41lpgm1:PH.*                           ALLOW  U41EXP_MONO
```

```
u41lpgm1:Mono.*                         ALLOW  U41EXP_MONO
```


The CA Gateway configuration repository

Generation of a report

```
./gateway-logs.sh gwc1c-ca.ca.bessy.de GATEWAY clear pvreport report
```

Restarting the gateway

```
./daemon-command.sh gwc1c-ca.ca.bessy.de blc12-192-168-82-0-24 cagateway stop start
```

The CA Gateway configuration repository

Gateway statistics panel

CA Gateway Statistics Overview							
gateway	connected	unconnected	existTestRate	gateway	connected	unconnected	existTestRate
MLS-bb1	3438	3678	105.05	blc12-192-168-82-0-24	13787	2669	277.94
MLS-mlsarc				blc13-192-168-83-0-24	2340	2846	86.14
MLS-mlscs				blc14-192-168-84-0-24	0	2820	65.43
MLS-mlsdi				blc15-192-168-85-0-24	4894	1927	305.05
MLS-portalt				blc16-192-168-86-0-24	1817	2781	306.75
MLS-portstd	9258	4049	105.85	ca-6164			
acc-192-168-101-0-24	0	96	308.95	ctl-192-168-21-0-24	230509	1616	272.03
acc-192-168-31-0-24	0	96	85.54	ctl-192-168-210-0-24	0	2690	308.85
acc-193-149-12-0-24	0	93	79.14	ctl-192-168-214-0-24	0	2692	90.74
blc-192-168-22-0-24	92839	2332	300.15	ctltest-192-168-21-0-24			
blc01-192-168-71-0-24	2557	1970	67.83	ctltest1-192-168-21-0-24			
blc02-192-168-72-0-24	0	1910	293.24	erl-172-18-38-0-24	382	2590	150.47
blc03-192-168-73-0-24	1346	2568	87.54	erlimp-172-18-38-0-24	385	2625	66.23
blc04-192-168-74-0-24	2115	1866	66.23	exp-172-17-0-0-24	130	3105	308.35
blc05-192-168-75-0-24	2095	2564	305.75	exp-172-17-10-0-24	21	2414	55.13
blc06-192-168-76-0-24	6557	2826	304.15	exp-172-17-64-0-24	1171	2586	279.24
blc07-192-168-77-0-24	768	3045	84.74	exp-172-17-72-0-24	66	2589	294.04
blc08-192-168-78-0-24	1674	3036	67.73	exp-172-17-73-0-24	50	2295	65.33
blc09-192-168-79-0-24	2092	3012	294.04	exp-172-17-9-0-24	214	2809	309.75
blc10-192-168-80-0-24	1292	2959	88.04	exp-192-168-11-0-24	83	2596	83.54
blc11-192-168-81-0-24	3711	2816	66.63	exp-192-168-26-0-24	26	2596	62.83

Useful commands and links

- BESSY CA Gateway concept:

<https://www-csr.bessy.de/control/ca-net-gateways/>

- How to clone the CA-Gateway repository

`hg clone http://repo.acc.bessy.de/hg/ca-net-gateways/`

- Pyexpander

<https://pyexpander.sourceforge.io/>

- Channel Access specification

https://docs.epics-controls.org/en/latest/specs/ca_protocol.html

- CA Gateway users guide

<https://epics.anl.gov/EpicsDocumentation/ExtensionsManuals/Gateway/Gateway.html>