Mutex + Lock = CsLibGuarded

RCU Sample Code

Barbara Geller & Ansel Sermersheim

March 2021

CsLibGuarded

- Use Case
  - one Sender object (pushButton) and one Receiver object (Window) are connected in a signal / slot relationship

  - senders keep track of their receivers in a receiver list
  - receivers keep track of their senders in a sender list

  - pushButton destructor
    - reads receiver list to find receivers, write to sender list
  - window destructor
    - reads sender list to find senders, write to receiver list

CsLibGuarded

- Use Case
  - requirements
    - writers can never block readers
    - iterators are not invalidated by writers
    - readers never block anyone
    - deleted elements do not invalidate iterators
  - rcu_list<T> class
    - manages a multi-threaded container
  - sample code
    - https://www.copperspice.com/pdf/2021-rcu-sample-code.pdf

Real World Example - Before CsLibGuarded RCU

```
CsSignal::SignalBase::~SignalBase()
{
  std::lock_guard<std::mutex> lock(m_mutex_connectList);

  if (m_activateBusy > 0)  {
    std::lock_guard<std::mutex> lock(get_mutex_beingDestroyed());
    get_beingDestroyed().insert(this);
  }

  for (auto & item : m_connectList) {
    const SlotBase * receiver = item.receiver;

    std::lock_guard<std::mutex> lock{receiver->m_mutex_possibleSenders};

    auto &senderList = receiver->m_possibleSenders;
    senderList.erase(std::remove_if(senderList.begin(), senderList.end(),
              [this](const SignalBase * x){ return x == this; }),
              senderList.end());
  }
}
```

Real World Example - After CsLibGuarded RCU

```
CsSignal::SignalBase::~SignalBase()
{
  auto senderListHandle = m_connectList.lock_read();

  for (auto & item : * senderListHandle) {
    auto receiverListHandle = item.receiver->m_possibleSenders.lock_write();
    auto iter = receiverListHandle->begin();

    while (iter != receiverListHandle->end())   {

      if (*iter == this) {
        iter = receiverListHandle->erase(iter);

      } else {
         ++iter;

      }
    }
  }
}
```

Where to find CopperSpice

- www.copperspice.com

- ansel@copperspice.com
- barbara@copperspice.com

- source, binaries, documentation files
  - download.copperspice.com

- source code repository for CsLibGuarded
  - github.com/copperspice/cs_libguarded