# Insights in Partial Failures

Leased object references and Unit Testing

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# Conditional Synchronization (CS)

- with Futures:

```
def testAsyncOneCustomer(){
  def future := when: customer<-haveComputer()@FutureMessage becomes:{
    |val|
    self.assertEquals(val, 1);
  };
  future;
};
```

- applying the `becomes:` block resolves `future`.
- applying the `catch:` block ruins `future`.



# CS with Futures

- Synchronization based on event or conditions by explicit future manipulation:

```
def [future, resolver] := makeFuture();
consumer<-give(future);
def val := /* calculate useful value */
      resolver.resolve(val);
      resolver.ruin(exception);
```



# CS in Unit Tests

```
def InstantMessengerTest(){
extend: /.at.unit.test.UnitTest.new("IMTest") with: {
    def test := self;
    def testAsyncMessageSend() {
      def [fut,res] := /.at.lang.futures.makeFuture();
      def IMGUI := object: {
         def init(im) { im.setUsername("Aact") };
         def display(text) {
           test.assertEquals("Added buddy: Bact", text);
           res.resolve(true);
         };
      };
      def A := createIM(IMGUI);
      // ... code to create peer B called Bact
    };
    fut;
  };
};
```

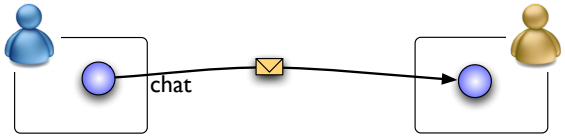
# CS in Unit Tests

```
def MyTest(){
extend: /.at.unit.test.UnitTest.new("MyTest") with: {

    def testAsyncWhenElapsed() {
      when: 2.seconds elapsedWithFuture: {
        self.assertEquals(3,1+2);
       };
    };
};

>MyTest.runTest()
```

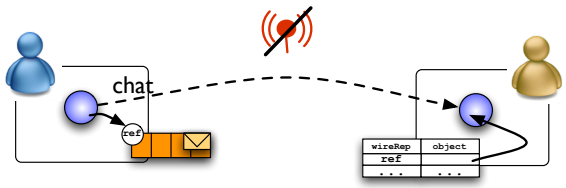
# Failure Handling




```
whenever: InstantMessenger discovered: {|chat|
  ...
  when: chat disconnected: {
    system.println("buddy offline");
  }
  when: chat reconnected: {
    system.println("buddy online");
  }
}
```



# Far References & Disconnections



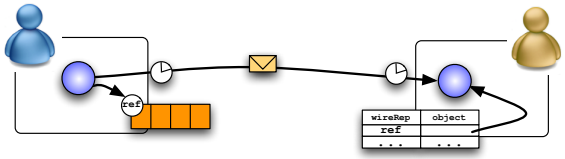

- Far references keep referring the remote object upon a disconnection!



# Permanent Disconnections

- But, the system cannot distinguish transient from permanent disconnections.
- Limite lifetime of the remote object references:

Leasing [grey89, waldo01]

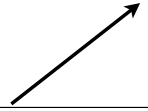


# Working with Leased Refs

```
import /.at.lang.leasedrefs;
```

- leasing integrated with remote references.

```
def session := object: {
  def addItemToCart(anItem) { ... }
  def checkOutCart() { ... }
};
def leasedSession := lease: 1.minutes for: session;
```



object serialization returns a leased far reference rather than a far reference.

# Working with Leased Refs

- Communication via asynchronous message passing, except for == method.
- Managing life cycle of a leased object reference:

```
renew: leasedRef for: timeInterval

revoke: leasedRef

leaseTimeLeft: leasedRef
```



# Working with Leased Refs

- Registering a closure that is executed when the leased reference expires:

```
when: session expired: {
  system.println("session with " + remotePeer + timed out.");
  //cleanup code for session
};
```

- Observers can be placed in both client and server side!
- An expired leased object reference behaves as a permanently disconnected far reference!



# Leasing Variants

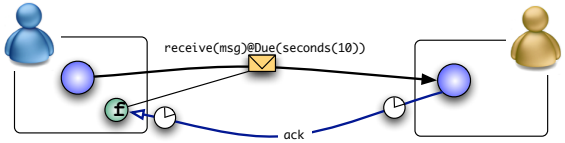
```
renewOnCallLease: timeout for: object
```

- the leased reference gets renewed as long as it receives messages.

```
singleCallLease: timeout for: object
```

- the leased reference gets revoked upon a successful method call on the server object.

# Leasing and Futures




```
when: buddy<-receive(msg)@Due(seconds(10)) becomes: { |ack|
  system.println( msg.content + " sent to: " + to)
} catch: TimeoutException using: { |e|
  system.println("msg: " + msg.content + " timed out.");
};
```

- Future is passed as a `singleCallLease` which expires:
  - upon reception of a `resolve` or `ruin` message
  - due to a timeout