Appendix A

Example of Presence Document

Below, an example of a user's PIDF presence document is shown, which includes information about the user and his or her devices and services [23] as well as his or her geographical coordinates [38].

```
<?xml version=''1.0'' encoding=''UTF-8''?>
  <presence xmlns=''urn:ietf:params:xml:ns:pidf''
     xmlns:dm=''urn:ietf:params:xml:ns:pidf:data-model''
     xmlns:lt=''urn:ietf:params:xml:ns:location-type''
     xmlns:rpid=''urn:ietf:params:xml:ns:pidf:rpid''
     entity=''pres:someone@example.com''>

 <tuple id=''bs35r9''>
   <status>
     <basic>open</basic>
     <gp:geopriv>
       <gp:location-info>
         <gml:location>
           <gml:Point gml:id="point1" srsName="epsg:4326">
             <gml:coordinates>37:46:30N 122:25:10W</gml:coordinates>
           </gml:Point>
         </gml:location>
       </gp:location-info>
       <gp:usage-rules>
         <gp:retransmission-allowed>yes</gp:retransmission-allowed>
         <gp:retention-expiry>2003-06-23T04:57:29Z</gp:retention-expiry>
       </gp:usage-rules>
     </gp:geopriv>
   </status>
```

```
    <dm:deviceID>urn:device:0003ba4811e3</dm:deviceID>
    <rpid:relationship><rpid:self/></rpid:relationship>
    <rpid:service-class><rpid:electronic/></rpid:service-class>
    <contact priority=‘‘0.8’’>im:someone@mobile.example.net</contact>
    <note xml:lang=‘‘en’’>Don’t Disturb Please!</note>
    <note xml:lang=‘‘fr’’>Ne derangez pas, s’il vous plait</note>
    <timestamp>2005-10-27T16:49:29Z</timestamp>
  </tuple>

  <tuple id=‘‘ty4658’’>
    <status>
      <basic>open</basic>
    </status>
    <rpid:relationship><rpid:assistant/></rpid:relationship>
    <contact priority=‘‘1.0’’>mailto:secretary@example.com</contact>
  </tuple>

  <tuple id=‘‘eg92n8’’>
    <status>
      <basic>open</basic>
    </status>
    <dm:deviceID>urn:x-mac:0003ba4811e3</dm:deviceID>
    <rpid:class>email</rpid:class>
    <rpid:service-class><rpid:electronic/></rpid:service-class>
    <rpid:status-icon>http://example.com/mail.png</rpid:status-icon>
    <contact priority=‘‘1.0’’>mailto:someone@example.com</contact>
  </tuple>

  <note>I’ll be in Tokyo next week</note>

  <dm:device id=‘‘pc147’’>
    <rpid:user-input idle-threshold=‘‘600’’
      last-input=‘‘2004-10-21T13:20:00-05:00’’>idle</rpid:user-input>
    <dm:deviceID>urn:device:0003ba4811e3</dm:deviceID>
    <dm:note>PC</dm:note>
  </dm:device>

  <dm:person id=‘‘p1’’>
    <rpid:activities from=‘‘2005-05-30T12:00:00+05:00’’
        until=‘‘2005-05-30T17:00:00+05:00’’>
        <rpid:note>Far away</rpid:note>
        <rpid:away/>
    </rpid:activities>
    <rpid:class>calendar</rpid:class>
    <rpid:mood>
```

```
      <rpid:angry/>
      <rpid:other>brooding</rpid:other>
    </rpid:mood>
    <rpid:place-is>
       <rpid:audio>
          <rpid:noisy/>
       </rpid:audio>
    </rpid:place-is>
    <rpid:place-type><lt:residence/></rpid:place-type>
    <rpid:privacy><rpid:unknown/></rpid:privacy>
    <rpid:sphere>bowling league</rpid:sphere>
    <rpid:status-icon>http://example.com/play.gif</rpid:status-icon>

    <rpid:time-offset>-240</rpid:time-offset>
    <dm:note>Scoring 120</dm:note>
    <dm:timestamp>2005-05-30T16:09:44+05:00</dm:timestamp>
  </dm:person>
</presence>
```

Appendix B

Example of RLMI Document

Below, an example of the RLMI document of a user's resource list is shown, which has been taken from [121]. Each resource's PIDF document contains basic information. Appendix shows an example of PIDF document with rich presence information.

```
<?xml version=``1.0'' encoding=``UTF-8''?>
<list xmlns=``urn:ietf:params:xml:ns:rlmi''
      uri=``sip:adam-friends@pres.vancouver.example.com''
      version=``1'' fullState=``true''>
  <name xml:lang=``en''>Buddy List at COM</name>
  <name xml:lang=``de''>Liste der Freunde an COM</name>
  <resource uri=``sip:bob@vancouver.example.com'''''>
    <name>Bob Smith</name>
    <instance id=``juwigmtboe'' state=``active''
              cid=``bUZBsM@pres.vancouver.example.com''/>
  </resource>
  <resource uri=``sip:dave@vancouver.example.com''>
    <name>Dave Jones</name>
    <instance id=``hqzsuxtfyq'' state=``active''
              cid=``ZvSvkz@pres.vancouver.example.com''/>
  </resource>
  <resource uri=``sip:ed@dallas.example.net''>
    <name>Ed at NET</name>
  </resource>
  <resource uri=``sip:adam-friends@stockholm.example.org''>
    <name xml:lang=``en''>My Friends at ORG</name>
    <name xml:lang=``de''>Meine Freunde an ORG</name>
  </resource>
```

```
</list>

--50UBfW7LSCVLtggUPe5z
Content-Transfer-Encoding: binary
Content-ID: <bUZBsM@pres.vancouver.example.com>
Content-Type: application/pidf+xml;charset=''UTF-8''

<?xml version=''1.0'' encoding=''UTF-8''?>
<presence xmlns=''urn:ietf:params:xml:ns:pidf''
     entity=''sip:bob@vancouver.example.com''>
  <tuple id=''sg89ae''>
    <status>
      <basic>open</basic>
    </status>
    <contact priority=''1.0''>sip:bob@vancouver.example.com</contact>
  </tuple>
</presence>

--50UBfW7LSCVLtggUPe5z
Content-Transfer-Encoding: binary
Content-ID: <ZvSvkz@pres.vancouver.example.com>
Content-Type: application/pidf+xml;charset=''UTF-8''

<?xml version=''1.0'' encoding=''UTF-8''?>
<presence xmlns=''urn:ietf:params:xml:ns:pidf''
     entity=''sip:dave@vancouver.example.com''>
  <tuple id=''slie74''>
    <status>
      <basic>closed</basic>
    </status>
  </tuple>
</presence>

--50UBfW7LSCVLtggUPe5z--
```

Appendix C

Example of Notification Filter Document

Below, an example notification filter for winfo events [145] is shown, which has been taken from [141]. This filter selects watcher information notifications to be sent when a subscription status has changed to "pending" or "waiting". Only the watchers that have a status of "pending" or "waiting" are included in the notification.

```
<?xml version=''1.0'' encoding=''UTF-8''?>
  <filter-set xmlns=''urn:ietf:params:xml:ns:simple-filter''>
    <ns-bindings>
      <ns-binding prefix=''wi''
                         urn=''urn:ietf:params:xml:ns:watcherinfo''/>
    </ns-bindings>
    <filter id=''123'' uri=''sip:presentity@example.com''>
      <what>
        <include>
          /wi:watcherinfo/wi:watcher-list/wi:watcher[@status=''pending''
          or @status=''waiting'']
        </include>
      </what>
      <trigger>
        <changed to=''pending''>
          /wi:watcherinfo/wi:watcher-list/wi:watcher/@status
        </changed>
      </trigger>
      <trigger>
```

```
        <changed to=''waiting''>
          /wi:watcherinfo/wi:watcher-list/wi:watcher/@status
        </changed>
      </trigger>
    </filter>
  </filter-set>
```

Appendix D

Example of Presence Authorization Document

An example of a presentity's presence authorization document is shown below, which has been taken from [177]. This document specifies permissions for the watcher "user@example.com", which is allowed to subscribe to the presentity's presence information (i.e., the element <sub-handling> contains the 'allow' value). The watcher is granted access to the presence data of all the services whose contact URI schemes are sip and mailto. Person information is also provided. However, since there is no <provide-devices>, no device information will be given to the watcher. Within the service and person information provided to the watcher, the <activities> element will be shown, as will the <user-input> element. However, any "idle-threshold" and "since" attributes in the <user-input> element will be removed. Finally, the presence attribute <foo> will be shown to the watcher. Any other presence attributes will be removed.

```
<?xml version=''1.0'' encoding=''UTF-8''?>
  <cr:ruleset xmlns=''urn:ietf:params:xml:ns:pres-rules''
    xmlns:pr=''urn:ietf:params:xml:ns:pres-rules''
    xmlns:cr=''urn:ietf:params:xml:ns:common-policy''>
    <cr:rule id=''a''>
      <cr:conditions>
        <cr:identity>
          <cr:one id=''sip:user@example.com''/>
        </cr:identity>
      </cr:conditions>
      <cr:actions>
```

```
        <pr:sub-handling>allow</pr:sub-handling>
      </cr:actions>
      <cr:transformations>
        <pr:provide-services>
          <pr:service-uri-scheme>sip</pr:service-uri-scheme>
          <pr:service-uri-scheme>mailto</pr:service-uri-scheme>
        </pr:provide-services>
        <pr:provide-persons>
          <pr:all-persons/>
        </pr:provide-persons>
        <pr:provide-activities>true</pr:provide-activities>
        <pr:provide-user-input>bare</pr:provide-user-input>
        <pr:provide-unknown-attribute
          ns=``urn:vendor-specific:foo-namespace''
          name=``foo''>true</pr:provide-unknown-attribute>
      </cr:transformations>
  </cr:rule>
</cr:ruleset>
```

Appendix E

Example of Watcher Information Document

Below, an example of watcher information document is shown, which has been taken from [178]. The list contains two watchers, one has subscribed to the presentity successfully and the other is pending for approval.

```
<?xml version=``1.0''?>
<watcherinfo xmlns=``urn:ietf:params:xml:ns:watcherinfo''
             version=``0'' state=``full''>
  <watcher-list resource=``sip:professor@example.net'' package=``presence''>
    <watcher status=``active''
             id=``8ajksjda7s''
             duration-subscribed=``509''
             event=``approved'' >sip:userA@example.net</watcher>
    <watcher status=``pending''
             id=``hh8juja87s997-ass7''
             display-name=``Mr. Subscriber''
             event=``subscribe''>sip:userB@example.org</watcher>
  </watcher-list>
</watcherinfo>
```

Appendix F

Detailed Formulas for Estimating Inter-Domain Presence Traffic

The mathematical formulas below counts the number of bytes exchanged between two federated domains through different kinds of subscription. These formulas give a detailed description of the bytes involved in the inter-domain traffic optimizations described in Section 5.1, and are therefore based on the scenario described by the variables in Table 5.1. The traffic involved in handling a subscription is split into three categories: initial, termination, and steady state traffic. Initial and termination traffic are due to the establishment and termination, respectively, of the subscription; steady state traffic is all the traffic exchanged in the time elapsed between the initial subscription and the termination of the subscription. Steady state messages can be due to subscription refreshes and presence notifications. The total number of bytes involved in any of the subscription types below is given by the sum of four variables: *initial* and *termination* for initial and termination messages, respectively, and $refreshes$ and *changes* for steady state messages. We refer the reader to Section 5.1 for more information about the event subscriptions below and the strategies for optimizing inter-domain traffic, namely Common Notify, View Sharing, Common Subscribe, and Federated Common Subscribe. Below, we refer to a method for obtaining watchers lists in Common Notify that consists in including the watchers lists in the NOTIFY messages (see Section 5.1) as WLN.

Common Notify's presence event subscriptions without WLN A presence subscription to each presentity is established.

$initial = pres * wat * (sub + sok + not + doc + nok)$
$changes = (pch * slife - 2) * pres * (not + doc + nok)$
$refreshes = (slife/sref - 1) * pres * wat * (sub + sok + not + doc + nok)$
$termination = pres * wat * (sub + sok + not + doc + nok)$

Common Notify's presence event subscriptions with WLN A presence subscription to each presentity is established, and presence notifications contain the list of watchers subscribed. We assume that by the time a presence change occurs the average number of active watchers is half the total number of watchers. This assumption determines the size of the watcher list included in each presence notification.

$initial = pres * wat * (sub + sok + not + doc + nok)$
$changes = (pch * slife - 2) * pres * (not + mpb + doc + mpb + wlenv + (wat/2) * wlit + nok)$
$refreshes = (slife/sref - 1) * pres * wat * (sub + sok + not + doc + nok)$
$termination = pres * wat * (sub + sok + not + doc + nok)$

View Sharing's presence event subscriptions with full trust A presentity's ACL document includes all of the presentity's watchers within the requester domain associated with their respective views. There is only one backend subscription from the watcher domain to the PS for each view. The requester domain handles a single ACL document that contains information about all of the presentity's views. This document contains a different rule element for $pfwat$ per cent of the watchers. Each of these rule elements contains a single member element with the URI of the watcher that is authorized to see the view. Other rule element represents the default view, which contains the rest of watchers.

$initial = pres*(1+pfwat*wat/100)(sub+sok+not+mpb+doc+mpb+aclenv+aclrl+(wat-(pfwat*wat/100))*aclmb+(pfwat*wat/100)*(aclrl+aclmb)+nok)$
$changes = (pch * slife - 2) * pres * ((pfwat * wat/100 + 1)/2) * (not + doc + nok)$
$refreshes = (slife/sref - 1) * pres * (pfwat * wat/100 + 1) * (sub + sok + not + mpb + doc + mpb + aclenv + aclrl + (wat - (pfwat * wat/100)) * aclmb + (pfwat *$

$wat/100) * (aclrl + aclmb) + nok)$
$termination = pres * (pfwat * wat/100 + 1) * (sub + sok + not + mpb + doc + mpb + aclenv + aclrl + (wat - (pfwat * wat/100)) * aclmb + (pfwat * wat/100) * (aclrl + aclmb) + nok)$

View Sharing's presence event subscriptions with partial trust ACL documents include the watcher and all the other watchers that are authorized to see the view associated with the watcher. As in full trust, there is only one backend subscription between the watcher domain and the PS for each view. The requester domain handles a different ACL document for each view, which includes a single rule and a single member element (i.e, for a single watcher). There is an ACL document for the default view that includes a single rule with a different member element for $(100 - pfwat)$ percent of the watchers. Thus, the number of ACL documents that the domains handle is $1 + \frac{pfwat*wat}{100}$.

$initial = pres * (sub + sok + not + mpb + doc + mpb + aclenv + aclrl + (wat - pfwat * wat/100) * aclmb + nok) + pres * pfwat * wat/100 * (sub + sok + not + mpb + doc + mpb + aclenv + aclrl + aclmb + nok)$
$changes = (pch * slife - 2) * pres * (pfwat * wat/100 + 1)/2 * (not + doc + nok)$
$refreshes = (slife/sref - 1) * pres * ((sub + sok + not + mpb + doc + mpb + aclenv + aclrl + (wat - pfwat * wat/100) * aclmb + nok) + pfwat * wat/100 * (sub + sok + not + mpb + doc + mpb + aclenv + aclrl + aclmb + nok))$
$termination = pres * ((sub + sok + not + mpb + doc + mpb + aclenv + aclrl + (wat - pfwat * wat/100) * aclmb + nok) + pfwat * wat/100 * (sub + sok + not + mpb + doc + mpb + aclenv + aclrl + aclmb + nok))$

View Sharing's presence event subscriptions with minimal trust ACL documents only include the watcher, and there is therefore a backend subscription for each watcher. However, if multiple watchers share a particular view, the presence changes are sent through one of the subscriptions and the watcher domain distributes the changes to all of the other watchers. The requester domain maintains a view for each watcher, and hence the number of ACL documents that it handles is equal to wat.

$initial = pres*wat*(sub+sok+not+mpb+doc+mpb+aclenv+aclrl+aclmb+nok)$
$changes = (pch * slife - 2) * pres * (pfwat * wat/100 + 1)/2 * (not + doc + nok)$
$refreshes = (slife/sref - 1) * pres * wat * (sub + sok + not + mpb + doc + mpb + aclenv + aclrl + aclmb + nok)$
$termination = pres * wat * (sub + sok + not + mpb + doc + mpb + aclenv + aclrl + aclmb + nok)$

Common Subscribe's presence event subscriptions The requester domain only establishes a presence subscription to each presentity. Each subscription request contains the list of watchers subscribed. This list is full-state and therefore contains all the watchers associated with the common subscription. When the requester domain refreshes a common subscription, half of the total number of watchers are active on average. Whenever a new watcher subscribes to a presentity, the requester domain refreshes the presentity's presence subscription in order to associate the watcher with the subscription. The messages involved in this kind of subscription refresh are counted by the *activations* variable.

$initial = pres*(sub+wlenv+wlit+sok+not+mpb+doc+mpb+wlenv+wlit+nok)$
$changes = (pch * slife - 2) * pres * (not + doc + nok)$
$refreshes = (slife/sref - 1) * pres * (sub + wlenv + (wat/2) * wlit + sok + not + mpb + doc + mpb + wlenv + (wat/2) * wlit + nok)$
$termination = pres * (sub + wlenv + wat * wlit + sok + not + mpb + doc + mpb + wlenv + wat * wlit + nok)$
$activations = pres * ((wat - 1) * (sub + sok + 2 * wlenv + not + 2 * mpb + doc + nok) + wlit * (wat * (wat + 1) - 2))$

Federated Common Subscribe's presence event subscriptions This kind of event subscription operates in the same way as Common Subscribe excepting that privacy filters are attached to any presence notification.

$initial = pres * (sub + wlenv + wlit + sok + not + mpb + doc + mpb + wlenv + wlit + pfwat * wat/100 * (mpb + pfdoc) + nok)$
$changes = (pch * slife - 2) * pres * (not + doc + nok)$

$refreshes = (slife/sref - 1) * pres * (sub + wlenv + (wat/2) * wlit + sok + not + mpb + doc + mpb + wlenv + (wat/2) * wlit + (pfwat * wat/100) * (mpb + pfdoc) + nok)$
$termination = pres * (sub + wlenv + wat * wlit + sok + not + mpb + doc + mpb + wlenv + wat * wlit + (pfwat * wat/100) * (mpb + pfdoc) + nok)$
$activations = pres * ((wat - 1) * (sub + sok + 2 * wlenv + not + 2 * mpb + doc + (pfwat * wat/100) * (mpb + pfdoc) + nok) + wlit * (wat * (wat + 1) - 2))$

Winfo event subscriptions A winfo subscription to each presentity is created. The presentity's PS notifies the watcher domain of a presentity's watcher list whenever a new watcher subscribes to the presentity. Winfo notifications are full-state, and hence the watcher lists contain all the watchers that are active at the notification time. By the time the watcher domain resubscribes to keep its winfo subscription alive, the average number of watchers subscribed is half the total number of watchers.

$initial = pres * (sub + sok + not + wlenv + wlit + nok)$
$changes = pres * ((wat - 1) * (not + wlenv + nok) + wlit * ((wat * (wat + 1)/2) - 1))$
$refreshes = (slife/sref - 1) * pres * (sub + sok + not + wlenv + (wat/2) * wlit + nok)$
$termination = pres * (sub + sok + not + wlenv + wat * wlit + nok)$

Privacy-filters event subscriptions The requester domain creates a privacy-filters subscription to each presentity. We assume that privacy filters do not change once they have been created.

$initial = pres * (sub + sok + not + (pfwat * wat/100) * (mpb + pfdoc) + nok)$
$changes = 0$
$refreshes = (slife/sref - 1) * pres * (sub + sok + not + (pfwat * wat/100) * (mpb + pfdoc) + nok)$
$termination = pres * (sub + sok + not + (pfwat * wat/100) * (mpb + pfdoc) + nok)$

Privacy-filters event subscriptions with watcher list in SUBSCRIBE messages The requester domain creates a privacy-filters subscription to each presentity. Each subscription request contains the list of watchers subscribed, and only the privacy filters associated with these watchers are notified. The *activations* variable counts the messages because of watchers that get subscribed, which requires downloading their privacy filters. We assume that when the subscription state is refreshed, the number of watchers that are active and have a privacy filter associated is equal to half $pfwat$ per cent of the watchers. The number of active watchers determines the number of privacy filters included in NOTIFY messages for refreshes. We assume that privacy filters do not change during the session time.

$initial = pres * (sub + wlenv + wlit + sok + not + pfdoc + nok)$

$changes = 0$

$refreshes = (slife/sref - 1) * pres * (sub + wlenv + (wat/2) * wlit + sok + not + ((pfwat * wat/100)/2) * (mpb + pfdoc) + nok)$

$termination = pres * (sub + wlenv + wat * wlit + sok + not + (pfwat * wat/100) * (mpb + pfdoc) + nok)$

$activations = pres * ((wat - 1) * (sub + wlenv + sok + not + (mpb + pfdoc) * ((pfwat * wat/100)/2) + nok) + wlit * ((wat * (wat + 1)/2) - 1))$

Appendix G

iCalendar and SECE Translation

The Internet Calendaring and Scheduling Core Object Specification (iCalendar) [217] defines a common format for openly exchanging calendaring and scheduling information across the Internet. SECE permits to schedule actions and even recurrences of actions through time-based rules. These rules use time statements to define when the actions have to be executed. For the sake of interoperability, SECE time statements can be translated into iCalendar expressions. Below, the main iCalendar properties and their equivalent SECE time expressions are shown.

FREQ Type of recurrence: secondly, minutely, hourly, daily, weekly, monthly, or yearly. Example:

```
DTSTART;TZID=America/New_York:20110527T090000
  RRULE:FREQ=YEARLY
```

SECE time statement: EVERY. Type of recurrence: every second, every minute, every hour, every day, every week, every month, or every year.

SECE example: every year from May 27, 2011

DTSTART The date on which the actions are executed. If it is a recurrence, DTSTART indicates when the first occurrence occurs. Example:

```
DTSTART;TZID=America/New_York:20111224T090000
  RRULE:FREQ=DAILY
```

SECE time statement: FROM

SECE example: every day from December 24, 2011

DTSTART contains the clock time at which the event has to be done. In the SECE language, a clock time can be specified by the *from* or *at* statements. A time in a *from* statement is suitable when the recurrence is secondly, minutely, or hourly (e.g., "every 30 minutes from Jan, 1, 2011, 9.00"). Otherwise, the *at* statement should be used (e.g., "on MO at 10:00 from September, 25, 2011").

When the *from* statement does not match the first occurrence of the recurrence, the DTSTART property should be calculated properly. For example, "on MO from November, 1, 2011" would be translated into an iCalendar expression with DTSTART set to November 7, 2011. If the *from* statement is not specified, DTSTART is set as the first date that matches the time expression indicated by the *on* statement. If neither the *from* nor *on* statement are specified, DTSTART takes the current date.

UNTIL The date on which a recurrence is no longer repeated. It can include a clock time, which only makes sense in secondly, minutely, and hourly recurrences. Example:

```
DTSTART;TZID=America/New_York:20110101T090000
    RRULE:FREQ=DAILY;UNTIL=20110915T090000
```

SECE time statement: UNTIL

SECE example: every day from January 1, 2011 until September 15, 2011

INTERVAL Frequency at which the recurrence occurs. The default value is one. For example, an interval of 3 in a weekly recurrence means "every 3 weeks". Example:

```
DTSTART;TZID=America/New_York:20110101T090000
    RRULE:FREQ=DAILY;INTERVAL=2;UNTIL=20110915T090000
```

SECE time statement: EVERY. A number in the every statement indicates the interval, as in "every 40 seconds".

SECE example: every 2 days from January 1, 2011 until September 15, 2011

COUNT Total number of occurrences in the recurrence. Example:

```
DTSTART;TZID=America/New_York:20110101T090000
   RRULE:FREQ=DAILY;COUNT=10
```

SECE time statement: FOR. The statement "for n times" means that the nth occurrence is the last one in the recurrence.

SECE example: every day from January 1, 2011 for 10 times

BYSECOND Seconds within a minute at which the event occurs. Example:

```
DTSTART;TZID=America/New_York:20110101T090000
 RRULE:FREQ=MINUTELY;COUNT=12;BYSECOND=30
```

SECE time statement: AT

SECE example: every minute at 30 second from January 1, 2011 for 12 times

BYMINUTE Minutes within an hour at which the event occurs. Example:

```
DTSTART;TZID=America/New_York:20110101T090000
   RRULE:FREQ=HOURLY;COUNT=24;BYMINUTE=20
```

SECE time statement: AT

SECE example: every hour at 20 minute from January 1, 2011 for 24 times

BYHOUR Hours of the day at which the event occurs. Example:

```
DTSTART;TZID=America/New_York:20110101T090000
   RRULE:FREQ=DAILY;BYHOUR=12;UNTIL=20110401T090000
```

SECE time statement: AT

SECE example: every day at 12:00 from January 1, 2011 until April 1, 2011

BYDAY Days of the week on which the event occurs. Valid values are SU, MO, TU, WE, TH, FR, and SA. Example:

```
DTSTART;TZID=America/New_York:20110101T090000
   RRULE:FREQ=WEEKLY;BYDAY=WE;COUNT=20
```

SECE time statement: ON

SECE example: every 2 weeks on WE from January 1, 2011 for 20 times

BYMONTH Months of the year on which the event occurs. Example:

```
DTSTART;TZID=America/New_York:20110701T120000
 RRULE:FREQ=YEARLY;BYMONTH=7
```

SECE time statement: ON or IN

SECE example: every year in July at 12:00 from July 1, 2011

BYMONTHDAY Days of the month on which the event occurs. Example:

```
DTSTART;TZID=America/New_York:20111230T090000
 RRULE:FREQ=YEARLY;BYMONTH=12;BYMONTHDAY=30
```

SECE time statement: ON

SECE example: every year on 30th day of December from December 30, 2011

BYMONTHDAY combined with BYDAY Days of the month that fall into particular weekdays. Example:

```
DTSTART;TZID=America/New_York:20110101T090000
  RRULE:FREQ=MONTHLY;BYDAY=FRI;BYMONTHDAY=13
```

SECE time statement: ON

SECE example: every month on 13 day and FR from January 1, 2011

BYYEARDAY Days of the year on which the event occurs. Example:

```
DTSTART;TZID=America/New_York:20111230T090000
  RRULE:FREQ=YEARLY;BYYEARDAY=365;INTERVAL=3
```

SECE time statement: ON

SECE example: every year on 365th day from December 30, 2011

BYWEEKNO Weeks of the year. Example:

```
DTSTART;TZID=America/New_York:20110101T090000
  RRULE:FREQ=YEARLY;BYWEEKNO=20
```

SECE time statement: ON

SECE example: every year on 20th week from January 1, 2011

BYDAY combined with BYWEEKNO A weekday in a week of the year. Example:

```
DTSTART;TZID=America/New_York:20120224T090000
 RRULE:FREQ=YEARLY;BYWEEKNO=8;BYDAY=FRI
```

SECE time statement: ON

SECE example: every year on FRI of 8th week from February 24, 2012

EXDATE List of date exceptions. Example:

```
DTSTART;TZID=America/New_York:20110101T120000
EXDATE;TZID=America/New_York:20110106T120000
   RRULE:FREQ=DAILY;BYHOUR=12;UNTIL=20110401T120000
```

SECE time statement: EXCEPT

SECE example: every day at 12:00 from January 1, 2011 until April 1, 2011 except January 6, 2011

RDATE List of additional dates. Example:

```
DTSTART;TZID=America/New_York:20110101T120000
RDATE;TZID=America/New_York:20110410T120000
   RRULE:FREQ=DAILY;BYHOUR=12;UNTIL=20110401T120000
```

SECE time statement: INCLUDING

SECE example: every day at 12:00 from January 1, 2011 until April 1, 2011 including April 10, 2011

SECE provides more flexibility than iCalendar, and hence some SECE time statements are not directly mappable to iCalendar properties:

- *For* statement, which indicates how long a recurrence lasts such as "for 36 days". This statement can be translated into an iCalendar UNTIL or COUNT property.
- *Except* and *including* statements with a time period (e.g., a month). These statements are translated into an EXDATE and RDATE, respectively, that include all the occurrences within the recurrence that falls into the specified time period.
- Special dates, which are well-known calendar dates like "Thanksgiving" or "Independence day" as well as days defined by the user in his or her calendar like "my birthday". A special date is replaced by its corresponding calendar date.
- *In* statement, which indicates a time range during which an hourly, minutely, or secondly recurrence is active such as "in working hours". Thus, the start and end times of the period specified by an *in* statement determine the times in the iCalendar FROM and UNTIL properties.
- *From/to* statement, which indicates the start and end times of the period during which an hourly, minutely, or secondly recurrence is active, such as "from 9:00 to 18:00". These times determine the times in the iCalendar FROM and UNTIL properties.

Appendix H

ANTRL Grammar for The SECE Language

```
compilationUnit : scripts EOF;

scripts : (script)+;

script : ( timeScript | ifScript | locationscript
        | communicationscript | reminderscript) CODE_BLOCK;

reminderscript : 'when' (INTEGER timetype ('before' | 'after')
                ((‘a’|’any’) 'meeting' | SENTENCE )
          | ((‘a’|’any’) 'meeting' | SENTENCE ) ('begins' |'finishes' ));

communicationscript : 'incoming' ('call' | 'SMS' | 'sms' | 'email'
        | 'IM' | 'im' | 'voicemail') ('from' (IDENT | ADDRESS
        | phonenumber | (ADDRESS'\'s' | (IDENT )*
        SUBJECT ) shortcut))? ('to' ((IDENT) | phonenumber
        | ADDRESS ))?
   | 'missed call' ('from' ((IDENT | ADDRESS) | phonenumber))?
     ('to' (GVIDENT |IDENT | phonenumber | ADDRESS ) )?
   | 'received call' ('from' ((IDENT|ADDRESS) | phonenumber ))?
     ('to' (IDENT | phonenumber | ADDRESS ))?
   | 'finished call' ('from' ((IDENT|ADDRESS) | phonenumber))?
     ('to' (GVIDENT | IDENT | phonenumber | ADDRESS ))?;

locationscript : (userid 'near' ((‘a’|’an’) IDENT | location )
        | userid 'within' (DECIMAL|INTEGER) lengthunit 'of' location
        | userid ('in' | 'outside of') ((‘a’|’an’) IDENT
```

```
        | (SENTENCE | polygon_coordinates ))
        | userid 'moved' (DECIMAL|INTEGER) lengthunit );

ifScript : 'if' ADDRESS 'changed'| 'if' ((shortcut) | ('my' |
     ADDRESS'\'s' | (IDENT)* SUBJECT ) shortcut )
     ( 'changed' | 'added'|'removed' | 'is' ('other than')? IDENT
     | 'other than' IDENT | relationaloperator (NUMBER4|INTEGER|DECIMAL));

timeScript : (single_event | recurrent_event );

lengthunit : ('yard' | 'yards') | ('mile' | 'miles') | ('foot' | 'foots')
    | ('meter' | 'meters') | ('kilometers' | 'kilometer' | 'kms' | 'km');

location : (SENTENCE | point_coordinates | userid);

polygon_coordinates : point_coordinates ','? point_coordinates ','?
     point_coordinates (','? point_coordinates )* ;

point_coordinates : DECIMAL('N'|'S') ','? DECIMAL('W'|'E') | ('-' )?DECIMAL
    ','? ('-')?DECIMAL | ('-')?INTEGER'd' DECIMAL ','? ('-')?INTEGER'd' DECIMAL;

phonenumber : (COUNTRYCODE)? (AREACODE)?
   (FORMATTEDPHONENUMBER | ((INTEGER|NUMBER4) )+);

shortcut : (IDENT |SHORTCUT) ;

userid: (IDENT |ADDRESS) ;

relationaloperator : '!=' | '==' | '<' | '>' | '>=' | '<=' | 'is' | 'is'?
     ('equal to' | ('less'|'lower') 'than' ('or equal to' )? |
     ('higher'|'greater') 'than' ('or equal to' )? | 'other than');

single_event : (('on' (date_expr | date_identifier ) | 'in' month (',' year )?)
       ('at' (time | time_identifier ))? ('in' TIMEZONE )?);

date_expr : (month (weekday_instance | cardinalday )| (ordinalday 'day' |
         weekday_instance ) 'of' month | ordinalday 'day' |(weekday 'in')?
         weekno 'week' ) (',' year ) | year '-'INTEGER '-' INTEGER |
         INTEGER '/' INTEGER '/' year ;

recurrent_event : ('every' every_expr ( ('on'| 'in') (recdate_expr |
   recurring_date_identifier ))?
   | 'every' (recdate_expr | recurring_date_identifier ))
   ('at' (time | time_identifier ) | ('at' number_list (('hour' | 'hours'| 'h')
        | ('min' | 'mins'| 'minute' | 'minutes')
```

```
        | ('sec' | 'secs' |'second' | 'seconds')  ))+
      | 'from' (time  | time_identifier ) 'to' (time | time_identifier )
      | 'in' IDENT)?
   ('from' ((date_expr | year | date_identifier) (',' (time |
       time_identifier ))?))?
   ('until' ((date_expr | year | date_identifier ) (',' (time |
      time_identifier ) )?))?
   ('for' INTEGER ('times'  | timetype ))?
   ( ('including'| 'except' )
       (date_expr |  date_identifier_notsum | month ) (',' time )?
       (',' (date_expr |  date_identifier_notsum | month) (',' time )?)*)*
    ('in' TIMEZONE  )?;

recurring_date_identifier :  (SUBJECT  | 'my' )? IDENT  ((IDENT )+)?;


date_identifier : ((SUBJECT  | 'my' )? IDENT ((IDENT )+)? ( ('+'|'-' )
    INTEGER  (('day' | 'days') | ('week' | 'weeks')| ('month' | 'months')
      | ('year' | 'years') ))?
    | INTEGER (('day' | 'days') | ('week' | 'weeks')  | ('month' | 'months')
      | ('year' | 'years') ) ('before' | 'after')
        (SUBJECT | 'my' )? IDENT  ((IDENT )+)?) ',' year;

date_identifier_notsum : (SUBJECT | 'my' {"my";})? (IDENT )+ ',' year ;

time_identifier :  IDENT (('+'|'-' ) INTEGER  (('hour' | 'hours'| 'h')
                          | ('min' | 'mins'| 'minute' | 'minutes')
                          | ('sec' | 'secs' |'second' | 'seconds')))?
        | INTEGER (('hour' | 'hours'| 'h') | ('min' | 'mins'| 'minute'
        | 'minutes') | ('sec' | 'secs' |'second' | 'seconds'))
        ('before' | 'after') IDENT;

date_expr_list: (date_expr |  date_identifier_notsum) (',' (date_expr
     | date_identifier_notsum))*;

number_list :   INTEGER (',' INTEGER  )*;

recdate_expr: ( month_list  (weekday_list | cardinal_list )? |
   (ordinal_list ('day'|'days') | weekday_list ) 'of' month_list
   | ordinal_list ('day'|'days')  'and' weekday_list
   | ordinal_list ('yearly' |'monthly'  )? ('day'|'days')
   | (weekday_list 'in' )?    weekno_list ('week'|'weeks')
   | weekday_list ) (',' year  )?;

month_list :    month   (',' month)*;
```

```
weekday_list : weekday (',' weekday )*;

cardinal_list : cardinalday  (',' cardinalday )*;

ordinal_list :  ordinalday  (',' ordinalday )*;

weekno_list:     weekno  (',' weekno)*;

timetype :       ('second' | 'seconds')
                 | ('minute' | 'minutes')
                 | ('hour' | 'hours')
                 | ('day' | 'days')
                 | ('week' | 'weeks')
                 | ('month' | 'months')
                 | ('year' | 'years');

every_expr :(INTEGER )? ( (('seconds' | 'second') )
         | (('minutes' | 'minute') )
         | (('hours' | 'hour') )
         | (('days' | 'day') )
         | (('weeks' | 'week') )
         | (('months'| 'month') )
         | (('years' | 'year') ));

time : (INTEGER ':' INTEGER (':' INTEGER )?  ('am' | 'pm')? );


cardinalday  : ('-')?INTEGER;

ordinalday :  ('-')?(ORDINAL | textordinalnumber  );

textordinalnumber :      'first'
                 | 'second'
                 | 'thrid'
                 | 'fourth'
                 | 'fifth'
                 | 'sixth'
                 | 'seventh'
                 | 'eighth'
                 | 'ninth'
                 | 'tenth'
                 | 'last';

weekday_instance :  (cardinalday  | ordinalday   )
```

```
            (('Monday' | 'MO')
          | ('Tuesday' | 'TU')
          | ('Wednesday' | 'WE')
          | ('Thursday' | 'TH' )
          | ('Friday' | 'FR')
          | ('Saturday' | 'SA')
          | ('Sunday'| 'SU'));

weekday : (cardinalday | ordinalday )?
            (('Monday' | 'MO')
          | ('Tuesday' | 'TU')
          | ('Wednesday' | 'WE')
          | ('Thursday' | 'TH' )
          | ('Friday' | 'FR')
          | ('Saturday' | 'SA')
          | ('Sunday'| 'SU') );

weekno  : ('-')?ORDINAL;

year : NUMBER4 ;

month   :       ('January' | 'Jan')
          |     ('February' | 'Feb')
          |     ('March' | 'Mar')
          |     ('April' | 'Apr')
          |     ('May')
          |     ('June' | 'Jun')
          |     ('July' | 'Jul')
          |     ('August' | 'Aug')
          |     ('September' | 'Sep')
          |     ('October' | 'Oct')
          |     ('November' | 'Nov')
          |     ('December' | 'Dec');


MULTILINE_COMMENT : '/*' .* '*/' ;

CODE_BLOCK :    '{' (~('}'|'{') | CODE_BLOCK)*'}';

STRING_LITERAL :   '"' ('"' '"' | c=~('"'|'\r'|'\n'))*'"';

CHAR_LITERAL :   '\'' . '\'' ;

fragment LETTER : ('a'..'z' | 'A'..'Z') ;
fragment DIGIT : '0'..'9';
```

```
COUNTRYCODE:      '+' DIGIT | '+' DIGIT DIGIT | '+' DIGIT DIGIT DIGIT ;

AREACODE
        :         '(' DIGIT+ ')' ;

NUMBER4 :         DIGIT DIGIT DIGIT DIGIT;
INTEGER : DIGIT+ ;

DECIMAL           :        INTEGER '.' INTEGER;
FORMATTEDPHONENUMBER
        :         '-'? INTEGER ('-' INTEGER )+ ;
ORDINAL :         INTEGER'th' ;

GVIDENT: 'google voice' | 'Google Voice' | 'GV' | 'gv' | 'googlevoice';

IDENT : LETTER (LETTER | DIGIT)*;

SUBJECT           :        IDENT'\'''s'? ;

TIMEZONE          :        LETTER+('/'LETTER+)?;

ADDRESS :         IDENT('.'IDENT)*'\@'IDENT('.'IDENT)+;

SHORTCUT:         IDENT('.'IDENT)+;

SENTENCE : '"' .* '"' ;

WS : (' ' | '\t' | '\n' | '\r' | '\f')+ ;
COMMENT : '//' .* ('\n'|'\r') ;
```

Appendix I

List of Publications

I.1 Book Chapters

- V. Beltran, K. Arabshian, and H. Schulzrinne, "Ontology-based user-defined rules and context-aware service composition system" in The Semantic Web ESWC 2011 Selected Workshop Papers, Lectures Notes in Computer Science, Springer, (to be published in 2011).

- V. Beltran and J. Paradells, "Presence User Modeling and Performance Study of Single and Multi-Throttling on Wireless Links", in The Fixed Mobile Convergence Handbook, pp. 431-456. CRC Press, September 2010. Available: http://www.crcpress.com/product/isbn/9781420091700

- X. Sanchez-Loro, J.Casademont, J.L.Ferrer, V.Beltran, M.Catalan and J.Paradells, "Dynamic content negotiation in web environments," in Context-Aware Computing and Self-Managing Systems. CRC Press, March 2009. [Online]. Available: http://www.crcpress.com/product/isbn/9781420077711

I.2 International Journals

- V. Beltran and J. Paradells, "Optimization of inter-domain presence traffic based on privacy rule sharing: Performance and Impact on the IMS" accepted to be published at the Journal of Network and System Management (indexed in JCR), Springer.

- V. Beltran and J. Paradells, “Strategies for reducing inter-domain presence traffic: an analytical study,” International Journal of Cooperative Information Systems (indexed in JCR), vol. 19, December 2010.

- X. Sanchez-Loro, Victoria Beltran, Jordi Casademont and Marisa Catalan, “A proxy-based system for dynamic content negotiation and collaborative optimization in hetereogenic environments”. Intelligent automation and soft computing (indexed in JCR), vol. 16, num. 4, p.553-566. January 2010.

- X. Sanchez-Loro, V. Beltran, J. Casademont, M. Catalan, “Ubiquitous Web Access: Collaborative optimization and dynamic content negotiation”, International Journal of Multimedia and Ubiquitous Engineering, Vol. 3, No. 3, July 2008.

I.3 International Conferences

- O. Boyaci, V. Beltran, and H. Schulzrinne, “Bridging communications and the physical world: Sense everything, control everything,” in Proceedings of the IPT-Comm Conference 2011, Chicago, USA, August 2011 (to be published).

- V. Beltran, K. Arabshian and H. Schulzrinne, “Ontology-based user-defined rules and context-aware service composition system,” in Proceedings of the Fourth International Workshop on Resource Discovery (RED 2011), colocated with the 8th Extended Semantic Web Conference (ESWC), pp. 21-35, Heraklion, Greece, May 2011.

- V. Beltran and J. Paradells, “SIP/SIMPLE Resource List Server: Optimization or Burden for Presence Systems,” in Proceedings of the Fourth Conf. on Context Awareness for Proactive Systems 2011, IEEE, Budapest, Hungary, May 2011.

- O. Boyaci, V. Beltran, and H. Schulzrinne, “Bridging communications and the physical world: Sense everything, control everything,” in Proceedings of the IEEE GLOBECOM 2010 (UbiCoNet workshop), pp. 1735-1740, Florida, USA, December 2010.

- X. Sanchez-Loro, V. Beltran, J. Casademont, and M. Catalan, "Ubiquitous web access and application layer optimization: Dynamic content negotiation over cellular links," Proceedings of the 3rd International Conference on Grid and Pervasive Computing - Workshops, pp. 269-274, IEEE Computer Society, Kunming, China, May 2008.

- X. Sanchez-Loro, V. Beltran, J. Casademont, and M. Catalan, "Ubiquitous web access: Collaborative optimization and dynamic content negotiation," Proceedings of the International Conference on Multimedia and Ubiquitous Engineering (MUE) (Workshop on Interactive Multimedia & Intelligent Services), pp. 558-563, Busan, Korea, April 2008.

- V. Beltran and J. Paradells, "Middleware-based solution to offer mobile presence services," in Proceedings of the 1st international conference on MOBILe Wireless MiddleWARE, Operating Systems, and Applications, ICST, Insbruck, Austria, February 2008.

- V. Beltran and J. Paradells, "Presence Functionality Approach to Achieve Fixed Mobile Converged Services," in Proceedings on the IEEE International Conference on Information Networking (ICOIN), Busan, Korea, January 2008.

- V. Beltran, X. Sanchez-Loro, J. Paradells, and J. Casademont, "Optimization of presence enabled services over cellular networks based on a personal proxy," in Proceedings of the IASTED European Conference: internet and multimedia systems and applications, pp. 75-81, ACTA Press, Chamonix, France, March 2007.

- J. Paradells, J. L. Ferrer, M. Catalan, W. Torres, M. Catalan-Cid, X. Sanchez-Loro, V. Beltran, E. Garcia, C. Gomez, P. Plans, J. Rubio, D. Almodovar, D. Rodellar, N. Subotic, D. Wenger, and I. Steiner, "Design of a umts/gprs assisted mesh network (uamn)," in Proceedings of the 17th Wireless World Research Forum (WWRF) Meeting, Serving and managing users in a heterogeneous enviroment, Germany, November 2006.

I.4 Demonstrations at International Conferences

- O. Boyaci, V. Beltran, and H. Schulzrinne, "Bridging communications and the physical world: Sense everything, control everything," in Demonstration at the IPTComm Conference 2010, Munich, Germany, August 2010.

I.5 National Conferences

- J. Paradells, M. Catalan, X. Sanchez-Loro, V. Beltran, J. L. Ferrer, M. Catalan-Cid, E. Garcia, P. Plans, and C. Gomez, "Red mallada asistida por umts/gprs," in Proceedings of the Jornadas de Ingenieria Telematica (JITEL) Conference, Malaga, Spain, September 2007.

I.6 Papers under Review Process

- V. Beltran and J. Paradells, "Publications in Presence Service: Overview and Optimization Techniques." Under review process to be published at the Journal of Research and Practice in Information Technology (indexed in JCR).

- V. Beltran and J. Paradells, "Control mechanisms of presence updates: A tradeoff between traffic optimization and information consistency." Under review process (second round with minor changes) to be published at the Computer Communications journal (indexed in JCR).

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