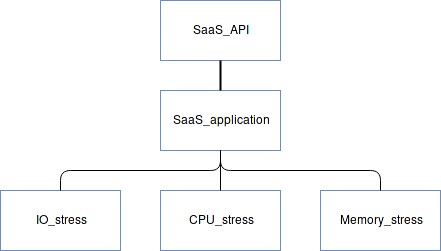
# Artificiële SaaS-applicatie

Er is bewust voor gekozen om geen bestaande SaaS-applicatie te gebruiken om onverwachts complex gedrag, zoals bugs, van dergelijke applicaties te vermijden. Daarom hebben we zelf een artificiële SaaS-applicatie ontwikkeld, die als doel heeft om een mutli-tenant SaaS-applicatie in zijn meest fundamentele vorm te simuleren. In dit hoofdstuk wordt het ontwerp en de implementatie van deze applicatie besproken.

## 4.1 Ontwerp



Figuur 4.1: Ontwerp SaaS-applicatie

Op figuur 4.1 staat het klassediagram. Het ontwerp van de applicatie leunt aan bij de COMITRE aanpak [31]. Er worden in COMITRE 7 stappen gedefinieerd. Stap 2 en 3 worden afgehandeld door onderliggende software. De andere stappen zijn mee in het ontwerp van de SaaS-applicatie verwerkt.

### 4. Artificiële SaaS-applicatie

De applicatie is geschreven in C++ en biedt een REST API (SaaS\_API) waarop tenants requests kunnen sturen (stap 1 in COMITRE). Deze requests bevatten een tenantId opdat de SaaS-applicatie de juiste tenant specifieke configuratie kan terug vinden (stap 4 in COMITRE). Wanneer geen configuratie beschikbaar is, wordt er teruggevallen op een standaard configuratie (zie stap 5). Op basis van de tenant specifieke instellingen worden de stressfuncties met de juiste parameters opgeroepen (zie stap 6).

De applicatie kan geconfigureerd worden om in multi-tenant of single-tenant mode te draaien. In multi-tenant mode is er een cache voorzien, deze wordt gebruikt om elke request tenant specifieke configuratie in te laden. Indien een tenant niet in de cache zit, wordt de configuratie file van de SaaS-applicatie nog eens ingelezen om het ophalen van tenant specifieke data te simuleren. De cache wordt op FIFO wijze gevuld. Wanneer de cache vol zit wordt de tenant die er al het langst in zit er uit gehaald.

Daarnaast kunnen er ook voor elke tenant apart parameters geconfigureerd worden om te bepalen welke resourcetypes (CPU, memory of disk I/O) voornamelijk gestrest zullen worden.

De applicatie kan geconfigureerd worden aan de hand van een YAML file. Een voorbeeld wordt gegeven in codeblock 4.1. De resourceparameters (CPU, memory en I/O) kunnen at run-time ook via de rest API ingesteld worden.

|  |
| --- |
| multi : true # Zet applicatie in multi*−*tenant mode cache\_size : 10 # cache size in multi*−*tenant mode mem\_intensity : 100 # size of memory to allocate in bytes  cpu\_intensity : 200 io\_intensity : 500 # size of f i l e to read/write in Kbytes (must be more then 10)  tenants : # Individuele configuratie voor tenants  1: # tenant id mem\_intensity : 120 cpu\_intensity : 110 io\_intensity : 0  2:  mem\_intensity : 300  cpu\_intensity : 0 io\_intensity : 0  3:  mem\_intensity : 0 cpu\_intensity : 0 io\_intensity : 300 |

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Code 4.1: SaaS-applicatie YAML configuratie voorbeeld

## 4.2 Implementatie

Voor de implementatie voor de verschillende stresstests is onder andere gekeken naar algemene benchmarks als lmbench[29], sysbench en stress-ng[39]. Deze hebben echter het doel om een systeem volledig te belasten en configureerbaarheid was hierbij niet

4.2. Implementatie

altijd mogelijk. De implementaties van deze benchmarks kwamen wel overeen met de methodes die Matthews et al. [27] hebben gebruikt om performantie-isolatie van virtuele machines te testen. Onze implementatie is dus grotendeels geïnspireerd door dit werk.

### CPU

|  |
| --- |
| int Cpu\_stress : : simulate () { i f ( stress\_size\_ != 0) { volatile float result = stress\_size\_ ; for ( int i = 0; i< 100 *∗* stress\_size\_ ; i++){ result = Cpu\_stress : : fac (30) ;  } return result ;  }  }  int Cpu\_stress : : fac ( int n) { i f (n == 1) {return 1;}  else {  int r = n*∗*Cpu\_stress : : fac (n *−* 1) ; return r ;  }  } |

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Code 4.2: CPU stress code

Voor de implementatie van de CPU stressmethode is gekozen om een relatief eenvoudige bewerking meerdere keren uit te voeren (faculteit van 30). De parameterwaarde die ingesteld kan worden, zal bepalen hoe vaak dit gedaan wordt in de grootteorde 100. Het volatile keyword is nodig om compileroptimalisaties te vermijden.

### Memory

|  |  |
| --- | --- |
| void StressMemory : : run ()  {  int iterations = memorySize\_ / 10;  i f ( iterations == 0) { iterations = 1;}  int memory\_block = (memorySize\_ *∗* BYTE) / iterations ; // Iteratively allocate memory in blocks of 10B for ( int i = 0; i < iterations ; i++) {  buffer . push\_back( ( void *∗*) malloc (memory\_block) ) ;  //Puts 1s in to the allocated memory so the allocated memory marked as in use .  memset( buffer . at ( i ) , 1 , memory\_block) ;  }  } void StressMemory : : release (){ i f (memorySize\_ != 0) { // Free the allocated memory int iterations = memorySize\_ / 10; | is |

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#### 4. Artificiële SaaS-applicatie

|  |  |  |
| --- | --- | --- |
| i f ( iterations == 0) { iterations = 1;}  for ( std : : vector<void *∗*>:: size\_type i = 0; free ( buffer . at ( i ) ) ;  }  }  } | i != buffer . size () ; | i++) { |

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Code 4.3: Memory stress code

Om memory toegang te testen is er gekozen om een bepaald geheugeblok te alloceren en te vullen met één’tjes. Dit wordt gedaan in blokken van 10 Byte om incrementeel inladen van data te simuleren. Er kan ingesteld worden hoeveel byte gebruikt wordt door de applicatie.

### I/O

|  |  |
| --- | --- |
| void Io\_stress : : run () { i f ( stress\_size\_ != 0){ std : : ofstream saas\_out ( "/tmp/saas\_out " ) ; for ( int i = 0; i < (KILOBYTE / 4) *∗* stress\_size\_ ;  saas\_out << "1" << "\n" ;  } saas\_out . close () ;  } | i++){ |

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Code 4.4: I/O stress code

Het uitvoeren van een I/O operatie is hier wegschrijven van data. Dit simuleert het wegschrijven van een resultaat voor een request. De parameter die ingesteld kan worden bepaald hoe groot de file is die weggeschreven wordt in kilobyte.

### API

Requests naar het programma kunnen gestuurd worden op een REST API. Naar /request in single tenant mode, en naar /request/<tenant id> in multi-tenant

mode. Voor elke request worden volgende operaties uitgevoerd:

|  |
| --- |
| mem\_stress*−*>run () ; cpu\_stress*−*>run () ; io\_stress*−*>run () ; mem\_stress*−*>release () ; |

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De redenering hierbij is dat een request een bepaalde hoeveelheid RAM-geheugen vereist, een berekening doet, deze wegschrijft en dan het gebruikte geheugen terug vrijgeeft. Indien voor een resource de parameterwaarde op nul is ingesteld, wordt er voor die resource geen code uitgevoerd.

# Detailed API of the multi-tenant SaaS:

The interface in C++ is as follows:

|  |
| --- |
| #ifndef SaaS\_app\_H |
| [2](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.h#L2) | #define SaaS\_app\_H |
| [3](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.h#L3) | class SaaS\_API; |
| [4](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.h#L4) | #include **"SaaS\_API.h"** |
| [5](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.h#L5) | #include **"yaml-cpp/yaml.h"** |
| [6](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.h#L6) |  |
| [7](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.h#L7) | class Saas\_application { |
| [8](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.h#L8) | **public:** |
| [9](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.h#L9) |  |
| [10](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.h#L10) | Saas\_application(); |
| [11](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.h#L11) |  |
| [12](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.h#L12) | **void** print\_application\_config(); |
| [13](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.h#L13) |  |
| [14](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.h#L14) | **bool** get\_multi(); |
| [15](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.h#L15) | **int** get\_mem\_intensity(**int**); |
| [16](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.h#L16) | **int** get\_io\_intensity(**int**); |
| [17](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.h#L17) | **int** get\_cpu\_intensity(**int**); |
| [18](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.h#L18) | **int** get\_cache\_size(); |
| [19](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.h#L19) |  |
| [20](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.h#L20) | **void** set\_mem\_intensity(**int**, **int**); |
| [21](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.h#L21) | **void** set\_io\_intensity(**int**, **int**); |
| [22](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.h#L22) | **void** set\_cpu\_intensity(**int**, **int**); |
| [23](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.h#L23) | **void** set\_cache\_size(**int**); |
| [24](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.h#L24) |  |
| [25](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.h#L25) | **int** single\_tenant\_request(); |
| [26](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.h#L26) | **int** multi\_tenant\_request(**int**); |
| [27](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.h#L27) |  |
| [28](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.h#L28) | **private:** |
| [29](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.h#L29) | std::vector<**int**> cache; |
| [30](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.h#L30) | YAML::Node config; |
| [31](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.h#L31) | **void** simulate(**int**, **int**, **int**); |
| [32](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.h#L32) | **void** tenant\_lookup(**int**); |
| [33](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.h#L33) | }; |
| [34](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.h#L34) |  |
| [35](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.h#L35) | #endif |

The REST API is defined as follows:

|  |
| --- |
| #include **<string>** |
| [2](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L2) | #include **<iostream>** |
| [3](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L3) | #include **"SaaS\_API.h"** |
| [4](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L4) | #include **"lib/crow\_all.h"** |
| [5](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L5) | #include **"Memory\_stress.h"** |
| [6](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L6) |  |
| [7](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L7) | SaaS\_API::SaaS\_API(Saas\_application\* application): |
| [8](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L8) | application(application) |
| [9](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L9) | {} |
| [10](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L10) |  |
| [11](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L11) | // /set\_mem/id/int |
| [12](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L12) | **void** SaaS\_API::setter\_api(crow::SimpleApp& app) { |
| [13](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L13) |  |
| [14](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L14) | CROW\_ROUTE(app, "/set\_mem/<int>/<int>") |
| [15](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L15) | ([this](**int** id, **int** mem\_intensity) { |
| [16](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L16) | CROW\_LOG\_INFO << "Setting mem param: " << mem\_intensity; |
| [17](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L17) | application->set\_mem\_intensity(id, mem\_intensity); |
| [18](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L18) | **return** "mem param has been set"; |
| [19](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L19) | }); |
| [20](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L20) |  |
| [21](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L21) | CROW\_ROUTE(app, "/set\_io/<int>/<int>") |
| [22](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L22) | ([this](**int** id, **int** io\_intensity) { |
| [23](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L23) | CROW\_LOG\_INFO << "Setting io param: " << io\_intensity; |
| [24](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L24) | application->set\_io\_intensity(id, io\_intensity); |
| [25](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L25) | **return** "io param has been set"; |
| [26](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L26) | }); |
| [27](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L27) |  |
| [28](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L28) | CROW\_ROUTE(app, "/set\_cpu/<int>/<int>") |
| [29](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L29) | ([this](**int** id, **int** cpu\_intensity) { |
| [30](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L30) | CROW\_LOG\_INFO << "Setting cpu param: " << cpu\_intensity; |
| [31](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L31) | application->set\_cpu\_intensity(id, cpu\_intensity); |
| [32](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L32) | **return** "cpu param has been set"; |
| [33](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L33) | }); |
| [34](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L34) |  |
| [35](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L35) | CROW\_ROUTE(app, "/set\_cache/<int>") |
| [36](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L36) | ([this](**int** cache\_size) { |
| [37](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L37) | CROW\_LOG\_INFO << "Setting cache param: " << cache\_size; |
| [38](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L38) | application->set\_cache\_size(cache\_size); |
| [39](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L39) | **return** "cache param has been set"; |
| [40](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L40) | }); |
| [41](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L41) | } |
| [42](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L42) |  |
| [43](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L43) | **void** SaaS\_API::multitenant\_api(crow::SimpleApp& app) { |
| [44](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L44) |  |
| [45](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L45) | CROW\_ROUTE(app, "/request/<int>") |
| [46](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L46) | ([this](**int** tenant\_id) { |
| [47](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L47) | // Maybe do not allow requests for id 0, as it is used as a reserved default id |
| [48](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L48) | CROW\_LOG\_INFO << "Multitentant request for id: " << tenant\_id; |
| [49](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L49) | application->multi\_tenant\_request(tenant\_id); |
| [50](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L50) | **return** "succes"; |
| [51](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L51) | }); |
| [52](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L52) | } |
| [53](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L53) |  |
| [54](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L54) | **void** SaaS\_API::single\_api(crow::SimpleApp& app) { |
| [55](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L55) | CROW\_ROUTE(app, "/request/") |
| [56](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L56) | ([this]() { |
| [57](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L57) | CROW\_LOG\_INFO << "Single tenant request"; |
| [58](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L58) | application->single\_tenant\_request(); |
| [59](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L59) | **return** "succes \n"; |
| [60](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L60) | }); |
| [61](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L61) | } |
| [62](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L62) |  |
| [63](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L63) | **void** SaaS\_API::expose() { |
| [64](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L64) | crow::SimpleApp app; |
| [65](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L65) | crow::logger::setLogLevel(crow::LogLevel::CRITICAL); |
| [66](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L66) | setter\_api(app); |
| [67](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L67) | **if** (application->get\_multi()) { |
| [68](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L68) | multitenant\_api(app); |
| [69](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L69) | } **else** { |
| [70](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L70) | single\_api(app); |
| [71](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L71) | } |
| [72](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L72) | app.port(5000).multithreaded().run(); |
| [73](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/SaaS_API.cpp#L73) | } |

All requests are GET requests  
  
To send a message to the API you have to use a GET request, or simply type in your browser, for example the following URL, http://<kubeserviceip>/setmem/0/25. In linux the following command does the job wget http://<kubeserviceip>/setmem/0/25  
  
/setmem/0/250  means you run the application as a single tenant and you set the time intensity of the algorithm for the entire application to 25  
  
wget http://<kubeserviceip>/request is basically the invocation of a single request  
  
Using pyton, such request can be sent using the package [urllib](https://docs.python.org/3/library/urllib.request.html#module-urllib.request) as follows:  
  
 self.path = "/request/" + str(tenant.tenant\_id)  
 self.request\_url = "http://" + self.ip + ":" + self.port + self.path  
  
 try:  
            urllib.request.urlopen(self.request\_url).read()  
 except:  
            self.timeout\_count += 1  
            print("timeout + 1: " + str(self.timeout\_count))  
  
The example-controller in github already implements a Request class that uses a Java REST client to invoke the API.   
  
The semantics of the API is best described by reading the thesis. For full reference, here's the implementation of the API  
  
It distinguishes between running the application as a multi-tenant application or as a single tenant application.

|  |  |
| --- | --- |
| Saas\_application::Saas\_application() | |
| [14](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L14) | { | |
| [15](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L15) | config = YAML::LoadFile("saas\_config.yaml"); | |
| [16](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L16) |  | |
| [17](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L17) | SaaS\_API\* api = **new** SaaS\_API(this); | |
| [18](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L18) | api->expose(); | |
| [19](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L19) | } | |
| [20](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L20) |  | |
| [21](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L21) | **int** Saas\_application::single\_tenant\_request() { | |
| [22](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L22) | simulate(get\_mem\_intensity(0), get\_cpu\_intensity(0), get\_io\_intensity(0)); | |
| [23](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L23) | } | |
| [24](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L24) |  | |
| [25](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L25) | **int** Saas\_application::multi\_tenant\_request(**int** tenant\_id) { | |
| [26](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L26) | tenant\_lookup(tenant\_id); | |
| [27](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L27) | // TODO: getters op basis van id maken. | |
| [28](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L28) | simulate(get\_mem\_intensity(tenant\_id), get\_cpu\_intensity(tenant\_id),  get\_io\_intensity(tenant\_id)); | |
| [29](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L29) | } | |
| [30](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L30) |  | |
| [31](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L31) | **void** Saas\_application::tenant\_lookup(**int** tenant\_id) { | |
| [32](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L32) |  | |
| [33](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L33) | **if** (std::find(cache.begin(), cache.end(), tenant\_id) == cache.end()) { | |
| [34](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L34) | //perform I/O | |
| [35](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L35) | std::ifstream in("saas\_config.yaml"); | |
| [36](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L36) | **if** (in.is\_open()) | |
| [37](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L37) | { | |
| [38](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L38) | CROW\_LOG\_INFO << "Id not in cache"; | |
| [39](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L39) | std::**string** line; | |
| [40](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L40) | **while** ( getline(in,line) ) | |
| [41](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L41) | { | |
| [42](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L42) | **if** (line.find("multi") == 0 ){ | |
| [43](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L43) | CROW\_LOG\_INFO << "Performing I/O"; | |
| [44](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L44) | } | |
| [45](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L45) | } | |
| [46](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L46) | in.close(); | |
| [47](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L47) | } | |
| [48](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L48) |  | |
| [49](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L49) | // Add to cache | |
| [50](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L50) | **if**(cache.size() >= get\_cache\_size()) { | |
| [51](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L51) | cache.erase(cache.begin()); | |
| [52](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L52) | } | |
| [53](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L53) | cache.push\_back(tenant\_id); | |
| [54](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L54) | std::cout << cache.size() << std::endl; | |
| [55](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L55) | } | |
| [56](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L56) | } | |
| [57](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L57) |  | |
| [58](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L58) | **void** Saas\_application::simulate(**int** mem, **int** cpu, **int** io) { | |
| [59](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L59) | StressMemory\* mem\_stress = **new** StressMemory(mem); | |
| [60](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L60) | Cpu\_stress\* cpu\_stress = **new** Cpu\_stress(cpu); | |
| [61](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L61) | Io\_stress\* io\_stress = **new** Io\_stress(io); | |
| [62](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L62) |  | |
| [63](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L63) | mem\_stress->run(); | |
| [64](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L64) | cpu\_stress->run(); | |
| [65](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L65) | io\_stress->run(); | |
| [66](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L66) | mem\_stress->release(); | |
| [67](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L67) | **delete** mem\_stress; | |
| [68](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L68) | **delete** cpu\_stress; | |
| [69](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L69) | **delete** io\_stress; | |
| [70](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L70) | } | |
| [71](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L71) |  | |
| [72](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L72) | **void** Saas\_application::print\_application\_config() { | |
| [73](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L73) |  | |
| [74](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L74) | std::cout << "multitenancy: "<< get\_multi() << std::endl; | |
| [75](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L75) | std::cout << "mem\_intensity: " << get\_mem\_intensity(0) << std::endl; | |
| [76](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L76) | std::cout << "cpu\_intensity: " << get\_cpu\_intensity(0) << std::endl; | |
| [77](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L77) | std::cout << "io\_intensity: " << get\_io\_intensity(0) << std::endl; | |
| [78](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L78) |  | |
| [79](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L79) | } | |
| [80](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L80) |  | |
| [81](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L81) | **bool** Saas\_application::get\_multi() { | |
| [82](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L82) | **return** config["multi"].as<**bool**>(); | |
| [83](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L83) | } | |
| [84](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L84) |  | |
| [85](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L85) | **int** Saas\_application::get\_mem\_intensity(**int** id) { | |
| [86](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L86) | **if** (config["tenants"][id]) { | |
| [87](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L87) | **return** config["tenants"][id]["mem\_intensity"].as<**int**>(); | |
| [88](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L88) | } **else** { | |
| [89](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L89) | **return** config["mem\_intensity"].as<**int**>(); | |
| [90](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L90) | } | |
| [91](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L91) | } | |
| [92](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L92) |  | |
| [93](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L93) | **int** Saas\_application::get\_io\_intensity(**int** id) { | |
| [94](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L94) | **if** (config["tenants"][id]) { | |
| [95](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L95) | **return** config["tenants"][id]["io\_intensity"].as<**int**>(); | |
| [96](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L96) | } **else** { | |
| [97](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L97) | **return** config["io\_intensity"].as<**int**>(); | |
| [98](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L98) | } | |
| [99](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L99) | } | |
| [100](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L100) |  | |
| [101](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L101) | **int** Saas\_application::get\_cpu\_intensity(**int** id) { | |
| [102](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L102) | **if** (config["tenants"][id]) { | |
| [103](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L103) | **return** config["tenants"][id]["cpu\_intensity"].as<**int**>(); | |
| [104](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L104) | } **else** { | |
| [105](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L105) | **return** config["cpu\_intensity"].as<**int**>(); | |
| [106](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L106) | } | |
| [107](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L107) | } | |
| [108](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L108) |  | |
| [109](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L109) | **int** Saas\_application::get\_cache\_size() { | |
| [110](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L110) | **return** config["cache\_size"].as<**int**>(); | |
| [111](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L111) | } | |
| [112](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L112) |  | |
| [113](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L113) |  | |
| [114](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L114) | **void** Saas\_application::set\_mem\_intensity(**int** id, **int** mem\_int) { | |
| [115](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L115) | CROW\_LOG\_INFO << "setting mem\_intensity " << mem\_int << " for id: " << id; | |
| [116](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L116) | **if** (config["tenants"][id]) { | |
| [117](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L117) | CROW\_LOG\_DEBUG << "setting for id: " << id; | |
| [118](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L118) | config["tenants"][id]["mem\_intensity"] = mem\_int; | |
| [119](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L119) | } **else** **if** (id == 0) { | |
| [120](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L120) | CROW\_LOG\_DEBUG << "setting default"; | |
| [121](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L121) | config["mem\_intensity"] = mem\_int; | |
| [122](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L122) | } **else** { | |
| [123](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L123) | CROW\_LOG\_WARNING << "Not a valid id: " << id << ". To change the default value, use id 0"; | |
| [124](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L124) | } | |
| [125](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L125) | } | |
| [126](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L126) |  | |
| [127](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L127) | **void** Saas\_application::set\_io\_intensity(**int** id, **int** io\_int) { | |
| [128](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L128) | CROW\_LOG\_INFO << "setting io\_intensity " << io\_int << " for id: " << id; | |
| [129](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L129) | **if** (config["tenants"][id]) { | |
| [130](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L130) | config["tenants"][id]["io\_intensity"] = io\_int; | |
| [131](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L131) | } **else** **if** (id == 0) { | |
| [132](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L132) | config["io\_intensity"] = io\_int; | |
| [133](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L133) | } **else** { | |
| [134](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L134) | CROW\_LOG\_WARNING << "Not a valid id: " << id << ". To change the default value, use id 0"; | |
| [135](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L135) | } | |
| [136](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L136) | } | |
| [137](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L137) |  | |
| [138](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L138) | **void** Saas\_application::set\_cpu\_intensity(**int** id, **int** cpu\_int) { | |
| [139](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L139) | CROW\_LOG\_INFO << "setting cpu\_intensity " << cpu\_int << " for id: " << id; | |
| [140](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L140) | **if** (config["tenants"][id]) { | |
| [141](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L141) | config["tenants"][id]["cpu\_intensity"] = cpu\_int; | |
| [142](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L142) | } **else** **if** (id == 0) { | |
| [143](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L143) | config["cpu\_intensity"] = cpu\_int; | |
| [144](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L144) | } **else** { | |
| [145](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L145) | CROW\_LOG\_WARNING << "Not a valid id: " << id << ". To change the default value, use id 0"; | |
| [146](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L146) | } | |
| [147](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L147) | } | |
| [148](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L148) |  | |
| [149](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L149) | **void** Saas\_application::set\_cache\_size(**int** cache\_size) { | |
| [150](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L150) | config["cache\_size"] = cache\_size; | |
| [151](https://dnetcode.cs.kuleuven.be/projects/t16-104/repository/revisions/master/entry/app/saas/src/Saas_application.cpp#L151) | } | |