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Using WebIDE as a teaching aid

Jahorina, 23. avgust 2016.



Layout of this presentation

- 1) Initial analysis
- 2) Development
- 3) Experiences and results
- 4) Future work



Initial analysis



Where can WebIDE be used?

- Introductory programming courses
(Fundamentals of Computing and
Programming Techniques)
 - Laboratory exercises
 - Homework
 - Exams (?)
- Other courses (?)



Benefits of WebIDE

- Simplified laboratory deployment
 - Less problems for students at home
- Remote monitoring & assistance
- Student familiarity
- Oriented towards learning and learner
- Integration with grading tools
- Improved plagiarism prevention



Shortcomings of WebIDE

- "Not a real IDE"
 - Neither are CodeBlocks / DevCPP / ...
 - Increasingly used in the industry
- Too distant from the "bare metal"
 - Students should learn to deal with problems
- Resource usage



Selected IDE: Cloud9

- Benefits:
 - Mature
 - Some support for C / C++
 - Easily extendible with JavaScript dynamically loadable modules, documented API
- Shortcomings:
 - Licensing (free version is somewhat crippled)
 - Security (not meant for multiuser)

The screenshot shows the Cloud9 IDE interface. The main editor displays a C program named 'hello-world.c'. The code includes standard headers, defines a function 'trazi_rijeku' to find a word in a string, and another function 'cenzura' to censor words. The main function prompts the user for text and displays the result. The terminal at the bottom shows the command 'hello-world.c' and the output 'Cenzura! tekst plast: ***'.

```
1 #include <stdio.h>
2 #include <string.h>
3 #include <ctype.h>
4
5 /* Trazi rijec u tekstu, ne obzirir se na velika i mala slova */
6 char *trazi_rijek(char *tekst, char *sta)
7 {
8     char *p = sta;
9     unsigned short duzina = strlen(p), polozaj = 0;
10    while (*tekst != '\0')
11    {
12        if (tolower(*tekst) == tolower(*sta))
13        {
14            r = tekst;
15        }
16        /* Ispitujemo da li se i ostala slova poklapaju */
17        tekst++;
18        sta++;
19    }
20    while (*sta != '\0')
21    {
22        if (tolower(*tekst) != tolower(*sta))
23        {
24            break;
25        }
26        tekst++;
27        sta++;
28    }
29    return r;
30 }
31
32 /* Proveravamo da li se pronadjeni citavi rijeci, a ne samo dio */
33 if (*sta == '\0' || !strcmp(*tekst, *sta))
34 {
35     /* Za rijeci duzine 1 imamo poseban tretman */
36     if ((duzina > 1) || ((polozaj == 0) || (*(tekst - 1) == ' ')))
37     {
38         return r;
39     }
40 }
41 }
```



Development



C9@ETF infrastructure


- User management
- Sandboxing
- Logging / tracking / remote assistance
- Course management (limited for now)



Student dashboard

The screenshot displays the C9ETF WebIDE Dashboard. The browser tabs include 'C9 Dashboard', 'c9.ETF.unsa.ba/status...', 'ETF WebIDE', and 'Osnove računarstva'. The address bar shows 'c9.ETF.unsa.ba/status.php'. The dashboard has a dark theme and a 'Logout' button in the top right corner.

Vaš WebIDE:


Server pokrenut. Kliknite ovdje

Novosti

17.8.2016 11:40 Nadamo se da vam se sviđa novi Dashboard :)

25.4.2016 09:30 C9 je neočekivano postao nedostupan oko 22h sinoć zbog neuspjelog restarta. Pošto je server fizički nedostupan neradnim danom, normalan rad je nastavljen tek jutros u 9:30. Izvinjavamo se zbog neugodnosti.

17.3.2016 07:40 Pojedini korisnici su prijavili probleme sa brisanjem dijela koda otkucanog za vrijeme dok traje snimanje (Saving). Pošto ovakvih problema nije ranije bilo, jedino što ih je moglo izazvati je neki bug u collab modu, pa će zbog toga ovaj mod do daljnjeg biti isključen.

10.3.2016 22:50 Korisnici sada mogu vidjeti **anotacije** u kodu za poruke kompajlera, debuggera i profileru (valgrind - tj. greške tipa curenje memorije, izlazak van opsega niza i pristup neinicijalizovanim vrijednostima će biti prikazane u trenutku kada se dogode), te je popravljen prikaz popup prozora kod kompajlerskih grešaka koji nakon prelaska na C++ povremeno nije radio.

9.3.2016 23:30 Nova funkcionalnost **collab mode** omogućuje tutorima da otvore ekran studenta i pomognu u vezi zadatka direktno u prozoru. Oboje kolaborativno radi na kodu (vide se dva kursora) a sa desne strane se može nađ kartica Collaborate u kojoj je chat prozor. Za sada oba korisnika imaju ime "You" što će u budućnosti također biti ispravljeno.

8.3.2016 23:30 Na zahtjev mnogobrojnih korisnika pokušali smo urediti da Debug način rada bude isključen po defaultu, mada izgleda da na nekim browserima je opet uključen. Molimo korisnika koji i dalje imaju ovakav problem da se jave radi debugginga.

8.3.2016 17:30 U proteklih 3-4 sata plugin Zadaci imao je grešku zbog koje je urađene zadatke zamjenjivao default main datotekom (hello world). Ova greška je popravljena a studenti koji su greškom obrisali zadatke mogu se javiti kako bi im bila vraćena prethodna verzija.

8.3.2016 2:50 Niz unaprjeđenja u administrativnom panelu omogućuje tutorima da definišu zadatke i dodaju/mijenjaju autotestove po želji bez kontaktiranja administratora.

6.3.2016 23:30 Uočili smo da povremeno dolazi do zastoja u radu naslovne stranice (prozora za prijavu) praćenog porukom 502 Bad Gateway i neobjašnjivog porasta opterećenja na serveru. Pokušavam otkriti uzrok problema, čini se da je nešto vezano za rad PHPa. Ovaj problem će u skorije vrijeme biti otklonjen.

3.3.2016 13:30 Jedna od novih funkcionalnosti je i procesiranje tzv. **core dump** datoteka (core, _core, _valgrind.core itd.) koje omogućuju da se ustanovi zašto se neki program krahirao. No ove datoteke koje su inače povelike nisu brisane tako da je nestalo prostora na disku servera. Uslijed ovoga je server bio povremeno nedostupan jutros. Nažalost backup procedura koju koristimo nije predviđjala ovu mogućnost tako da su za nekih 10ak korisnika potpuno obrisani radni folderi ali i njihov backup tako da se ne može vratiti. Ovim korisnicima se izvinjavamo. Srećom semestar je tek počeo tako da nije izgubljeno puno.

26.2.2016 15:30 U letu je popravljen određeni broj problema sa novom verzijom. Ukinuta je nebitna poruka "Debugger connection error: null"

Prikaži više novosti...

Trenutno prijavljeni (5):

- atopalovic1
- dcuturic1
- hbezdrob1
- smezić1
- test

c9

- 15.65 GB
- 1.64
- 1.17 GB
- 5
- 0

c9prim

- 7.43 GB
- 0.38
- 0.96 GB
- 3
- 2

c9sec

- 7.16 GB
- 0.04
- 0.96 GB
- 2
- 1

c9nfs

- 7.28 GB
- 0.54
- 0.6 GB
- 2



Plugins & userspace tools

- Assignment plugin
- Homework plugin
- GCC output parsing
- Improvements to GDB integration
- Valgrind integration
- Buildservice integration
- Collaboration tools



Assignment plugin

The screenshot shows the Cloud9 IDE interface. The top menu bar includes 'Cloud9', 'File', 'Edit', 'Find', 'View', 'Goto', 'Run', 'Tools', 'Window', 'Support', 'Preview', 'Pošalji zadaću', and 'Run'. The left sidebar contains a file explorer with the following structure:

- Izaberite predmet:
 - ▼ Osnove računarstva
 - ▼ Tutorijal 4
 - Zadatak 1
 - Zadatak 2
 - Zadatak 3
 - Zadatak 4
 - Zadatak 5
 - Zadatak 6
 - ▶ Tutorijal 5
 - ▶ Tutorijal 6
 - ▶ Tutorijal 7
 - ▶ Tutorijal 8
 - ▶ Tutorijal 9
 - ▶ Tutorijal 10
 - ▶ Tutorijal 11

The main editor window shows a file named 'main.cpp' with the following C++ code:

```
6
7 using namespace std;
8
9 class Student {
10 protected:
11 string ime;
12 int indeks;
13 public:
14 Student(string ime, int ind) : ime(ime), indeks(ind) {}
15 virtual ~Student() {}
16 string DajIme() const { return ime; }
17 int DajIndeks() const { return indeks; }
18 virtual void Ispisi() const {
19 cout << "Student " << ime << " ima indeks " << indeks;
20 }
21 };
22 class DiplomiraniStudent : public Student {
23 int godina_diplomiranja;
24 public:
25 DiplomiraniStudent(string ime, int ind, int god_dipl) :
26 Student(ime, ind), godina_diplomiranja(god_dipl) {}
27 int DajGodinuDiplomiranja() const { return godina_diplomiranja; }
28
29 void Ispisi() const override {
30 cout << "Student " << ime << ", diplomirao " << godina_diplomiranja <<
31
32 }
33 };
```



GCC plugin

```
33     }
34     double p,q;
35     std::cout<<"Unesite p i q: ";
36     std::cin>>p>>q;
37
38     Matrica x(a.size()*p, a[0].size()*q);
39     x=EkspanzijaMatrice(a, p, q);
40
41     for(int i(0); i<x[0].size(); i++)
42     {
43         for(int j(0); j<x[0].size(); j++)
```

no matching function for call to 'std::vector<std::vector<double> >::v...

```
1 #include <iostream>
2 #
3 using namespace std;
4 int main() {
5     int a, y;
6     std::cout << "Zadaca 1, Zadatak 1\n"; // lklk lklk lklk lklk ovr
7     string x;
8     cin >> x;
9     cout << "Unijeli ste: "<<x << " a="<< a << endl;
10    cin >> a;
11    return 0;
12 }
13
14
15
```

Pristup neinicijalizovanoj vrijednosti

TP/T2/Z1/main.cpp - x TP/Z1/Z1/main.cpp TP/Z1/Z2/main.cpp - x TP/...

Stop Run Config Name

Running /home/test/workspace/TP/Z1/Z1/main.cpp
/home/test/workspace/TP/Z1/Z1/main.cpp: In function 'int main()':
/home/test/workspace/TP/Z1/Z1/main.cpp:5:16: warning: unused variable 'y' [-Wunused-variable]
 int a, y;
 ^

Zadaca 1, Zadatak 1
ad
Unijeli ste: ad a=0



GCC plugin

```
3 using namespace std;
4 int main() {
5     int a, y;
6     std::cout << "Zadaca 1, Zadatak 1\n"; // lklk lklk lklk lklk ovo j
7     string x;
8     cin >> x;
9     cout << "Unijeli ste: "<<x << " a"<< a << endl;
10    cin >> a;
11    cout << "a"<<a;
12    return 0;
13 }
14
15
```

Kompajlerska greška

Vaš program se nije kompajlirao jer imate grešku u liniji 9
expected ';' before 'cout'

OK

```
TP/T2/Z1/main.cpp - x TP/Z1/Z1/main.cpp - x TP/Z1/Z2/main.cpp - x TP/T2/Z1/main.cpp TP/T2/Z2/main.cpp - x +
Run Run Config Name
/home/test/workspace/TP/Z1/Z1/main.cpp: In function 'int main()':
/home/test/workspace/TP/Z1/Z1/main.cpp:9:9: error: expected ';' before 'cout'
  cout << "Unijeli ste: "<<x << " a"<< a << endl;
  ^
/home/test/workspace/TP/Z1/Z1/main.cpp:5:16: warning: unused variable 'y' [-Wunused-variable]
  int a, y;
  ^
```



Automated testing using Buildservice





Student group overview

Login: vljubovic - [logout](#)

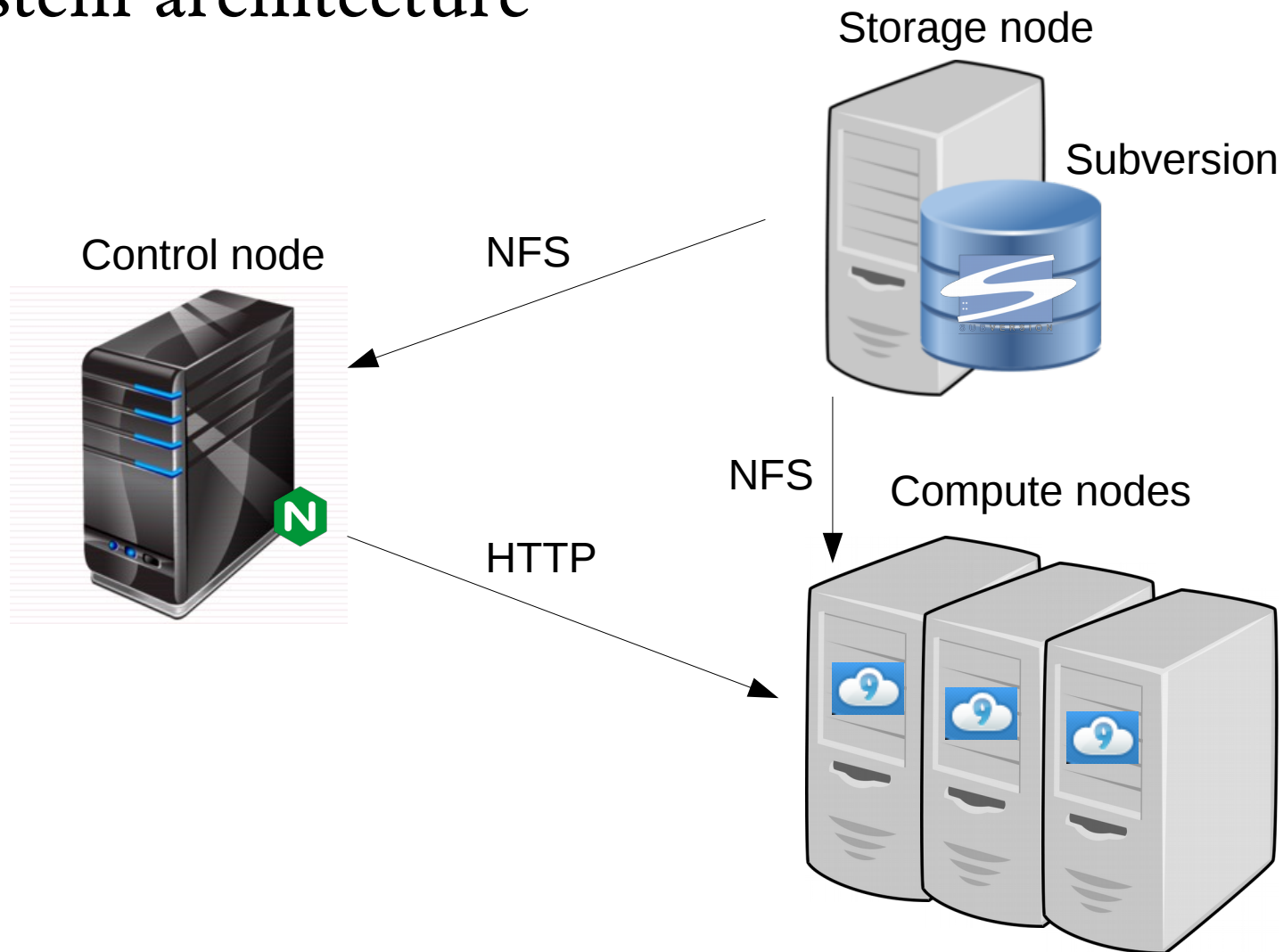
RI 1/A

[Ažuriraj statistike za čitavu grupu](#)

Ime i prezime	Posljednji pristup	Opcije	T1	T10	T11	T12	T13	T2	T3
Abaz Amer	30.04.2016 18:44:07		78.32 0 0	/	/	/	/	31.1 0 0	46.63 0 0
Abazović Ajla	Nikada		22.38 0 0	/	/	/	/	/	14 0 0
Aćimović Dejan	01.07.2016 19:19:38		74.98 0 0	69.87 0 0	139.98 0 0	85.87 0 0	93.88 0 0	101.8 0 0	63.07 1 0
Aganović Asim	18.08.2016 03:25:05		84.93 0 0	46.47 0 0	58.35 0 0	127.48 0 0	56.22 0 0	217.15 0 0	100.83 0 0
Ahmetović Enis	24.06.2016 00:26:29		10.33 0 0	143.65 0 0	155.88 0 0	147.62 0 0	99.55 0 0	81.73 0 0	68.37 0 0
Ajdinović Haris	13.08.2016 01:38:31		65.13 0 0	87.43 0 0	110.45 0 0	84.93 0 0	31.55 0 0	92.02 0 0	72.83 0 0
Alagić Lamija	10.08.2016 00:50:30		137.48 0 0	/	217.43 0 0	/	/	9.48 0 0	137.17 0 0



System architecture









Logging of all student activities

Srijeda, 24.02.2016

- 23:40:21 promijenjeno ime datoteke iz TP_T1_Z1 u TP/T1/Z1
- 23:40:21 promijenjeno ime datoteke iz TP_T1_Z2 u TP/T1/Z2
- 23:40:21 obrisana datoteka TP/T1/Z3
- 23:40:21 kreirana datoteka TP/T1/Z3
- 23:40:21 promijenjeno ime datoteke iz TP_T1_Z3 u TP/T1/Z3
- 23:40:21 kreirana datoteka TP/T1

Ponedjeljak, 22.02.2016

- 03:20:54 logout
- 09:02:35 login
- 09:05:24 promijenjeno ime datoteke iz New Folder u TP/T1/Z1
- 09:09:30 kreirana datoteka TP/T1/Z1/main.cpp
- 09:10:15 - 09:11:05 rad na datoteci TP/T1/Z1/main.cpp
- 09:11:07 program TP/T1/Z1 kompajliran i pokrenut
- 09:11:20 program TP/T1/Z1 kompajliran i pokrenut
- 09:11:30 - 09:11:54 rad na datoteci TP/T1/Z1/main.cpp
- 09:12:58 - 09:20:59 rad na datoteci TP/T1/Z1/main.cpp
- 09:21:06 program TP/T1/Z1 kompajliran i pokrenut
- 09:21:48 - 09:22:13 rad na datoteci TP/T1/Z1/main.cpp
- 09:22:15 program TP/T1/Z1 kompajliran i pokrenut
- 09:22:29 - 09:22:29 rad na datoteci TP/T1/Z1/main.cpp

Ime i prezime	Posljednji pristup	Opcije	Z1	Z2	Z3	Z4
Ćimović Dejan	01.07.2016 19:19:38	   	 16.38  8	 0.45  1	 42.05  34	 16.1  12



Experiences



- Budget: \$0
- Memory was bottleneck, not CPU!
 - From 30 simultaneous users to 300+
- Lab work successful
- Homeworks: plagiarism detection / prevention mostly not used
- Exams – successful!



Exams on computer take less time (per student)

Type of exam	Written exam	Oral exam	WebIDE exam
Avg. minutes per student	5-10	~15	3,5



Future work



More plugins for teaching assistance

- C & C++ documentation
- Smart assistance
 - Based on code, error message and knowledge base of common errors
- "Help me" plugin
 - Allows student to ask for contextual help from other student, but not allow other student to do their assignment for them



Detailed traces of student activity

- Keypresses
- Compile messages
- Testing results

```
03:20:54 logout
09:02:35 login
09:05:24 promijenjeno ime datoteke iz New Folder u TP/T1/Z1
09:09:30 kreirana datoteka TP/T1/Z1/main.cpp
09:10:15 - 09:11:05 rad na datoteci TP/T1/Z1/main.cpp
09:10:15 int
09:10:20 int a,b
09:10:21 int a,b,c
09:10:22 int a,b,c;
09:10:24
09:10:25 cin
09:10:26 cin<<
09:10:28 cin<<a
09:10:29 cin<<a<<
09:10:30 cin<<a<<b
09:10:32 cin<<a<<b<<c
09:10:33 cin<<a<<b<<c;
09:10:34
09:10:37 cout
09:10:41 cou
09:10:42 cou
09:10:50 cina<<b<<c;
09:10:51 cin?a<<b<<c;
09:10:52 cin>>a<<b<<c;
09:10:56 cin>>ab<<c;
09:10:57 cin>>a??b<<c;
09:10:58 cin>>ab<<c;
09:10:59 cin>>a??b<<c;
09:11:00 cin>>ab<<c;
09:11:02 cin>>a>b<<c;
09:11:04 cin>>a>bc;
09:11:05 cin>>a>b>c;
```




Vedran Ljubović

Automated evaluation of student homework: Lessons learned

25/26

Thank you for your
attentions!

Questions & Answers



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