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Subject: Decimal

Posted by [mirek](#) on Fri, 01 Aug 2008 08:10:31 GMT

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Well, it looks like Firebird seems to force us to add Decimal support.

I was googling a bit and found there two relevant topics:

<http://docs.python.org/lib/module-decimal.html>

<http://www.yoda.arachsys.com/csharp/decimal.html>

It looks like there are some standards -> I would recommend to follow them here.

Mirek

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Subject: Re: Decimal

Posted by [masu](#) on Fri, 01 Aug 2008 08:31:54 GMT

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There is also a WP article on DFP:

[http://en.wikipedia.org/wiki/Decimal\\_floating\\_point](http://en.wikipedia.org/wiki/Decimal_floating_point)

It also contains links to the actual IEEE standard.

Matthias

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Subject: Re: Decimal

Posted by [mirek](#) on Fri, 01 Aug 2008 09:18:37 GMT

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Well, completely opposite idea...

Maybe we could use int128 (supported by both MSC and GCC) and sort of fixed point, only removing last 4 or 5 bits of number to specify the precision (as number of significant places).

That would give us ability to represent  $10^{20}$  numbers with up to  $10^{-16}$  precision (if I have computed numbers well).

Mirek

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Subject: Re: Decimal

Posted by [aldeacity](#) on Sat, 02 Aug 2008 11:30:02 GMT

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Hello,

perhaps int128 would be a very good idea . But, sorry if I make a mistake, but, until now, how does Oracle for Upp manage number(x,y) data?

Juan.

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Subject: Re: Decimal

Posted by [unodgs](#) on Sat, 02 Aug 2008 11:54:32 GMT

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aldeacity wrote on Sat, 02 August 2008 07:30Hello,

perhaps int128 would be a very good idea . But, sorry if I make a mistake, but, until now, how does Oracle for Upp manage number(x,y) data?

Juan.

All decimal types in other databases are converted to double. I will try to implement int128 based decimal.

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Subject: Re: Decimal

Posted by [mirek](#) on Sat, 02 Aug 2008 12:21:07 GMT

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Well, here is something to start with

```
#include <Core/Core.h>
```

```
using namespace Upp;
```

```
double pow2(int x)
```

```
{  
    double b = 1;  
    while(x--)  
        b *= 2;  
    return b;  
}
```

```
typedef __int128_t int128;
```

```
#define I128_10_17 (int128)I64(1000000000) * (int128)I64(1000000000)
```

```
struct Decimal {  
    int128 data;
```

```

static int128 e10[38];

public:
void Add(const Decimal& b) {
    byte sa = data & 15;
    byte sb = b.data & 15;
    data = (~(int128)15 & data) + (~(int128)15 & b.data) | max(sa, sb);
}
void Mul(const Decimal& b) {
    byte sa = data & 15;
    byte sb = b.data & 15;
    data = (((~(int128)15 & data) * (~(int128)15 & b.data)) / l128_10_17) | max(sa + sb, 16);
}

String ToString() const;
const char *Scan(const char *s);

Decimal();
};

int128 Decimal::e10[38];

Decimal::Decimal()
{
    static bool init;
    if(!init) {
        int128 q = 1;
        for(int i = 0; i < 38; i++) {
            e10[i] = q;
            q = q * 10;
        }
    }
    data = 0;
}

String Format128(int128 a)
{
    RTIMING("Format128");

    if(a < 0)
        a = -a;
    char b[50];
    char *p = b + 50;
    do {
        *--p = a % 10 + '0';
        a = a / 10;
    }
}

```

```

while(a);
return String(p, b + 50);
}

```

```

const char *Decimal::Scan(const char *s)
{
    while(*s == ' ')
        s++;
    bool neg = false;
    if(*s == '-') {
        neg = true;
        s++;
    }
    while(*s == ' ')
        s++;
    if(!IsDigit(*s))
        return NULL;
    data = 0;
    while(IsDigit(*s))
        data = *s++ - '0' + 10 * data;
    int digits = 0;
    if(*s == '.') {
        s++;
        while(IsDigit(*s) && digits < 16) {
            data = *s++ - '0' + 10 * data;
            digits++;
        }
        while(IsDigit(*s)) s++;
    }
    data *= e10[16 - digits];
    if(neg)
        data = -data;
    data = (data & ~(int64)15 & data) | digits;
    return s;
}

```

```

String Decimal::ToString() const
{
    int digits = data & 15;
    String x = Format128(~(int64)15 & data);
    int n = x.GetLength();
    if(n <= 16)
        return "0." + x.Mid(0, digits);
    return x.Mid(0, n - 16) + "." + x.Mid(n - 16, digits);
}

```

```

Decimal Dec(const char *s)
{

```

```

Decimal d;
d.Scan(s);
return d;
}

```

```

inline Decimal operator+(const Decimal& a, const Decimal& b)
{
    Decimal r = a;
    r.Add(b);
    return r;
}

```

```

inline Decimal operator*(const Decimal& a, const Decimal& b)
{
    Decimal r = a;
    r.Mul(b);
    return r;
}

```

```

CONSOLE_APP_MAIN

```

```

{
    DUMP(Dec("1.20"));
    DUMP(Dec("1.20") + Dec("2"));
    DUMP(Dec("1.02") + Dec("1.005"));
    DUMP(Dec("1.02") * Dec("1"));
    DUMP(Dec("1.02") * Dec("0.50"));
    DUMP(Dec("1.02") * Dec("1.005"));
    return;
}

```

```

RDUMP(Format128(I128_10_17));

```

```

int64 x = I64(0x1234123412341234);
DUMP(Format64Hex(x & ~(int64)15));
Decimal a;
Decimal b;
a.Add(b);
for(int i = 0; i < 128; i++) {
    LOG(i << ' ' << pow2(i));
}
}

```

Conversions and + work, \* not yet... You will need to adjust typedef for MSC.

Mirek

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