



# touchdevelop

productive scripting  
ON  
mobile devices

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Manuel Fahndrich, Sebastian Burckhardt, Judith Bishop,  
Tom Ball

Microsoft Research

```
***** COMMODORE 64 BASIC V2 *****  
64K RAM SYSTEM 38911 BASIC BYTES FREE  
READY  
10 PRINT "HELLO WORLD"  
20 GOTO 10  
RUN
```

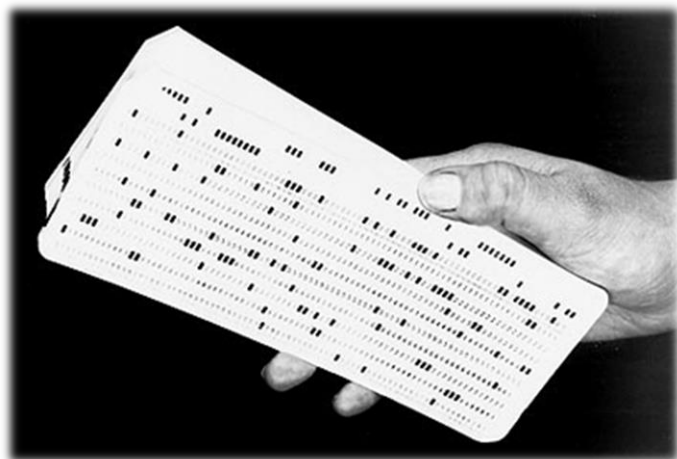


how to program  
smartphones + tablets?

how can you turn your  
ideas into reality?



# interfaces having always been changing

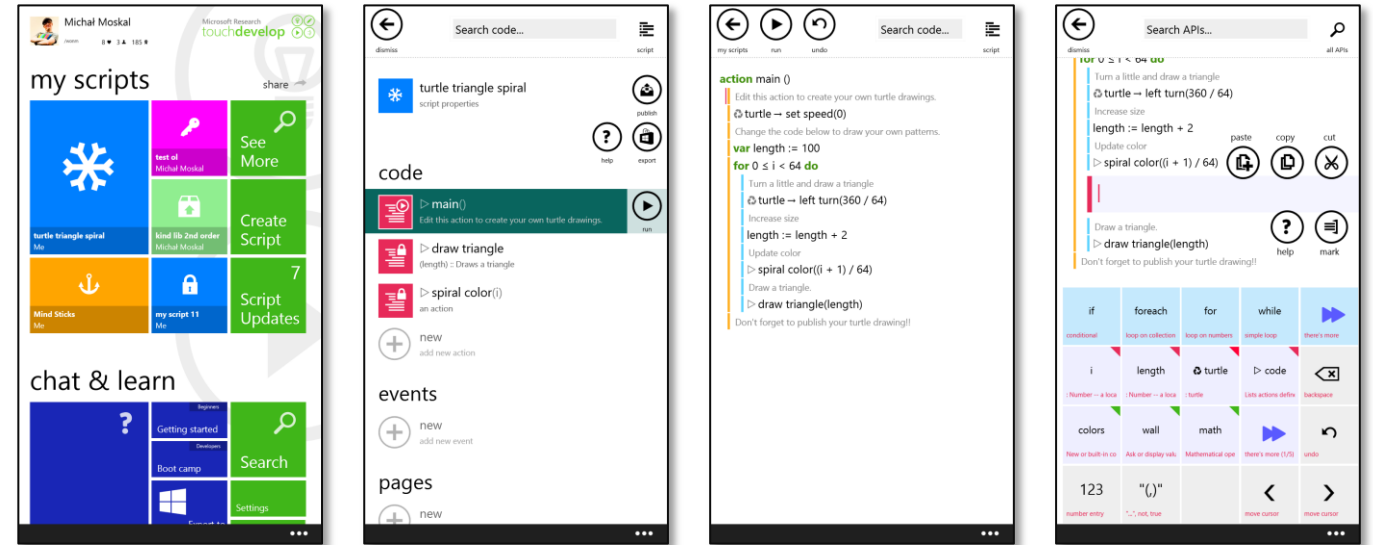




# touchdevelop: a touch-first IDE

video

Windows Phone app  
(2011)

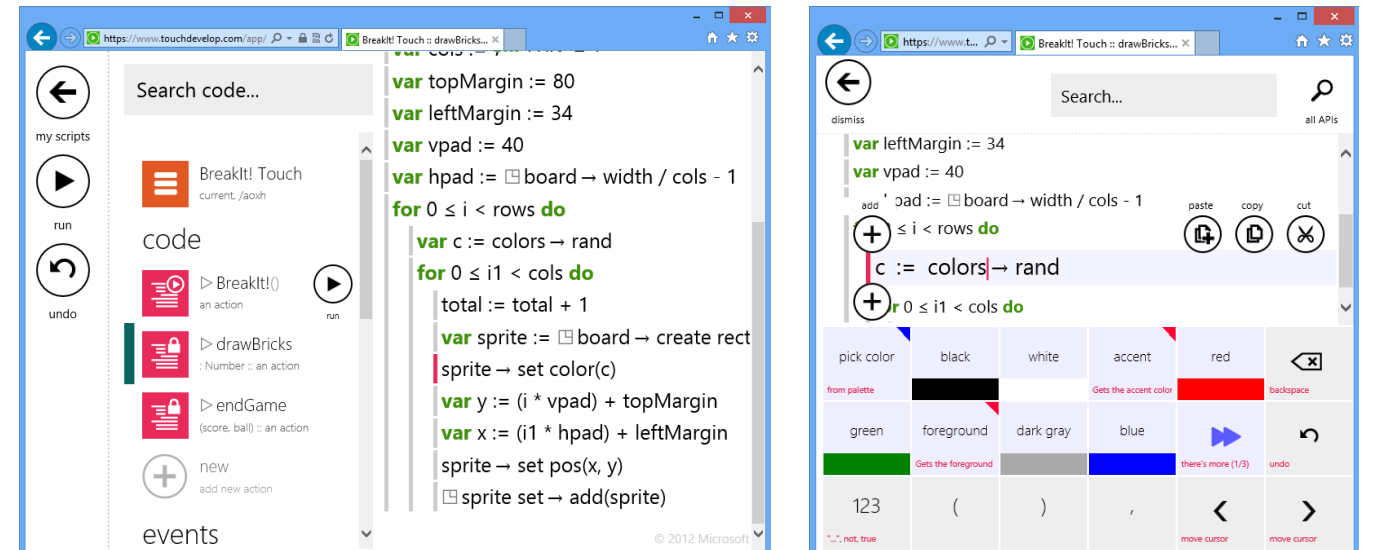


web app (2012)

iPhone, iPad,

Android

Windows, Mac, Linux





# touchdevelop demo

Interactive tutorial, language, editor, publishing  
hub, insights, debugging

tdev.ly/aslwa:      Electronic Constructor

tdev.ly/wbxsa:      Cloud Hopper

write chat client

tdev.ly/hdbo:      Mitingo  
                         Sphero

<http://10.125.128.1/internet/index.php>  
[touchdevelop.com](http://touchdevelop.com)



# touchdevelop.com

370,000+  
app downloads

140,000+  
registered users

50,000+  
published scripts

700+  
apps in stores





# who are our users

total beginners

students

enthusiasts & hobbyists

serious developers

... your name here ...

goal: anyone with a computing device





# language + editor

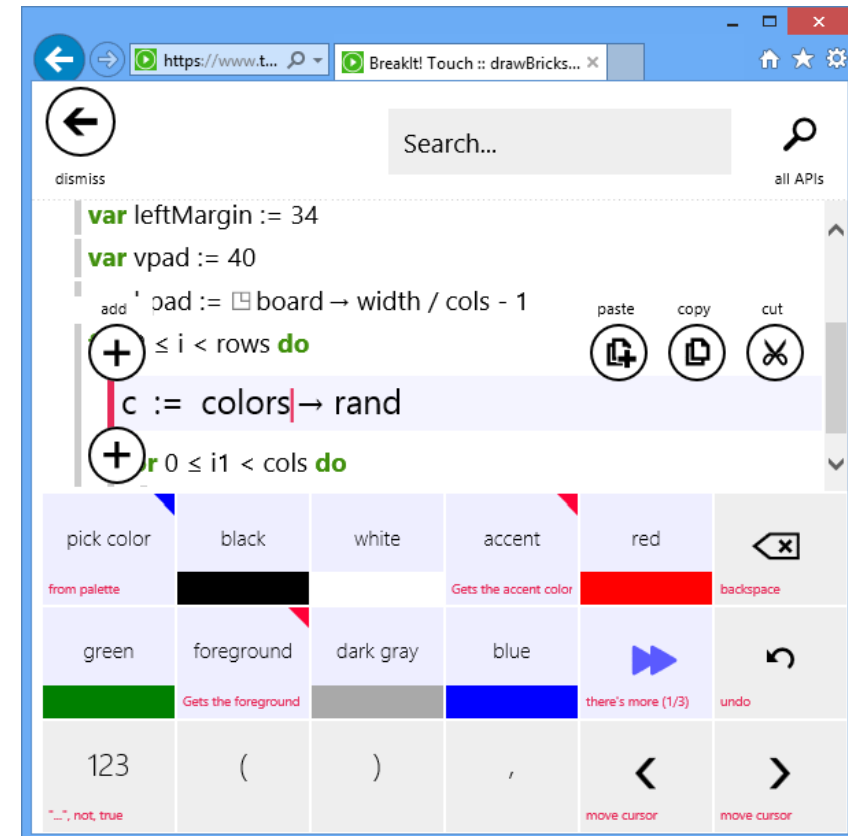
## typed language + semi-structured editor

typed, imperative, procedural,  
data-structures, lambda expressions,  
module system

expressions edited as token sequences

auto-completion by crowd-sourcing

high-level abstractions





# abstract syntax

```
script ::= meta-info decl*
decl   ::= action | page | event | global | library | record
action ::= private? action sig stmt*
event  ::= event sig stmt*
page   ::= private? page sig init stmt* display stmt*
sig     ::= id (id : type)* returns (id : type)*
global ::= var id : type flag*
record ::= cloud? (object | table | index | decorator) keys (id : type)* values (id : type)*
stmt    ::= expr | // comment | if expr then stmt* else stmt*
        | loop do stmt* | boxed stmt*
loop    ::= while expr | for id < expr | for each id in expr
expr    ::= token* (where sig stmt*)*
```



# cloud state - eventual consistency made easy

declare shared data (tables, indices) in your script  
write code to create view +  
attach event handlers

it just works:

data automatically synchronizes  
and displays  
data is replicated locally,  
always available, even if not connected  
zero error handling code





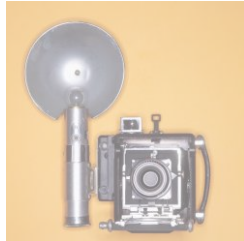
# code + run scripts on all devices





# access to sensors and data

camera?, touch, accelerometer?, compass?, radio?,  
gyroscope?, microphone?, location, NFC?, phone?,  
bluetooth?, contacts?, calendar?, email, pictures?,  
songs?, web queries, search, maps, social networks,  
oauth v2, graphics with physics engine,  
forms with automatic layout, ...



x?: depends on your device/browser

[touchdevelop.com/platforms](http://touchdevelop.com/platforms)



# touchdevelop education



touch**develop** + education = ♥♥♥

Bring Your Own Device (BYOD)

students can bring their own phone, tablet, laptop (or use a provided PC)

**students can keep working at home,  
and show results to family and fields**

cross-platform

touch**develop** fits today's heterogeneous reality





# touch**develop** + education today (1)

workshops, conferences

DeMobile @ FSE'13, MobileDeLi, ProMoTo @ SPLASH'13, MOBILESoft'14 @ ICSE'14

University collaborations

University of Newcastle (Australia), Drew University, University of Maryland, University of Calgary (Canada), Graz Univ. of Technology (Austria), IIT-Delhi (India), University of Illinois in Urbana Champaign, University of California in Santa Cruz

High school collaboration

Rainier Beach High School

book, courses, tutorials





# touchdevelop + education today (2)



Rainier Beach High School organized the first **App Day** on May 23, 2013. More than 500 students from 17 schools attended the event!

[video](#)

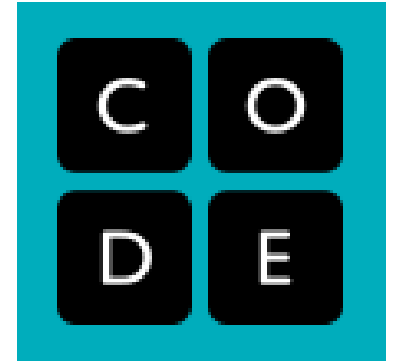
[appday.org](http://appday.org)





# touchdevelop + edu tomorrow: **code.org**

code.org is soliciting tutorials for “hour of code”,  
a campaign to inspire **TEN MILLION** students  
to learn to code



*“Microsoft, Google, Apple, Amazon, Bill Gates, Mark  
Zuckerberg, Jack Dorsey Among Those Joining Campaign”*

[touchdevelop.com/hoc](http://touchdevelop.com/hoc)



# touchdevelop research

[link](#)



# high-velocity research platform

IDE powered by the **cloud**

**data mining:** 1,000+ active user every day, 3,000,000+ program snapshots

social features (sharing, attribution, discussions, ...)

**information-flow** analysis to deal with privacy concerns

**crowd-sourced** profiling, code coverage, crash reporting

ranking of code by **novelty**

**live programming**

debugging on mobile devices

code-completion hints (**intellibuttons**) based on code mining

cloud-based **code synthesis** from keywords

**cloud state**

**adaptive tutorials**

one intern per topic!



# publications

Sihan Li, Tao Xie, and Nikolai Tillmann

A Comprehensive Field Study of End-User Programming on Mobile Devices, in *VL/HCC 2013*

Sebastian Burckhardt, Manuel Fahndrich, Jonathan de Halleux, Jun Kato, Sean McDirmid, Michal Moskal, Nikolai Tillmann

It is alive! Continuous Feedback in UI Programming, in *PLDI 2013*

Tuan A. Nguyen, Christoph Csallner, and Nikolai Tillmann

GROPG: A graphical on-phone debugger, in *ICSE NIER 2013*

Xusheng Xiao, Nikolai Tillmann, Manuel Fahndrich, Jonathan de Halleux, and Michal Moskal,

User-Aware Privacy Control via Extended-Static-Information-Flow Analysis, in *ASE 2012*

Nikolai Tillmann, Michal Moskal, Jonathan de Halleux, Manuel Fahndrich, Judith Bishop, Arjmand Samuel, and Tao Xie,

The Future of Teaching Programming is on Mobile Devices, in *ITiCSE 2012*

Sebastian Burckhardt, Manuel Fahndrich, Daan Leijen, and Benjamin P. Wood,

Cloud Types for Eventual Consistency, in *ECOOP 2012*

Tuan A. Nguyen, Sarker T.A. Rumeen, Christoph Csallner, and Nikolai Tillmann,

An experiment in developing small mobile phone applications comparing on-phone to off-phone development, in *USER 2012*

Marat Akhin, Nikolai Tillmann, Manuel Fahndrich, Jonathan de Halleux, and Michal Moskal,

Search by Example in TouchDevelop: Code Search Made Easy, in *SUITE 2012*

Nikolai Tillmann, Michal Moskal, Jonathan de Halleux, and Manuel Fahndrich,

TouchDevelop: programming cloud-connected mobile devices via touchscreen, in *ONWARDS 2011*



# many open challenges...

## plug-ins for cloud development

mining data to help new users learn programming,  
clone detection, analyze small incremental changes, gamification

## leverage structured program code repository

better version control (diff, merge), real-time collaborative editing

## our current research focus

collaborative editing, automatic code splitting for distributed execution (mobile vs. cloud),  
direct editing of JavaScript or TypeScript

... your research here ...



# data mining

REST-based service APIs at <http://touchdevelop.com/api/...>

| lists            | properties                  |
|------------------|-----------------------------|
| /api/scripts     | /api/[id]                   |
| /api/users       | /api/[scriptid]/text        |
| /api/comments    | /api/[scriptid]/ast         |
| /api/screenshots | /api/[scriptid]/successors  |
| /api/reviews     | /api/[scriptid]/base        |
| /api/tags        | /api/[userid]/scripts       |
| /api/art         | /api/[scriptid]/comments    |
| ...              | /api/[scriptid]/screenshots |
|                  | /api/[scriptid]/reviews     |
|                  | /api/[userid]/picture       |
|                  | ...                         |

[touchdevelop.com/help/cloudservices](http://touchdevelop.com/help/cloudservices)



# touchdevelop summary



# touch**develop**: a cloud-based mobile IDE

re-envisioned programming experience in a world of devices

develop and  
run **everywhere**



opportunity  
in **education**



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# touchdevelop code-a-thon

[touchdevelop.com/hoc](http://touchdevelop.com/hoc)



**create your  
own apps**



0:00 / 0:48



YouTube

