

# hackerspace global grid

world domination - one measurement at a time

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shackspace - devision for aerospace research, space exploration and other  
improbable sciences

27. Oktober 2012



# Once upon a time

- There were 3 guys wanting to understand satellite communications
- Build networked receiver stations just for kicks

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# Now

- Joined forces with the Constellation project (Andreas Hornig)
- We're building a distributed measurement network
- Aiming to track HAMSATs

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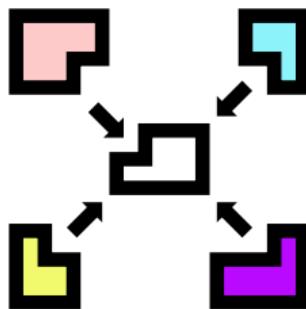
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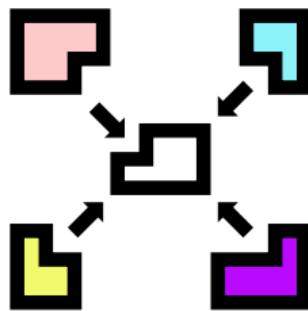


# Build a modular system



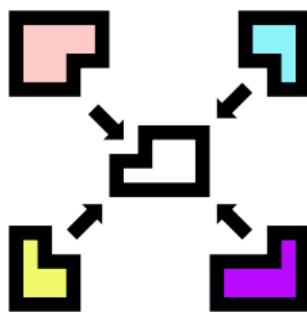
- Easier to develop
- Easier to extend
- Easier to improve

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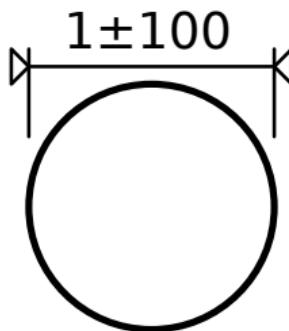
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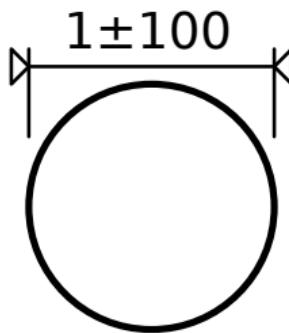
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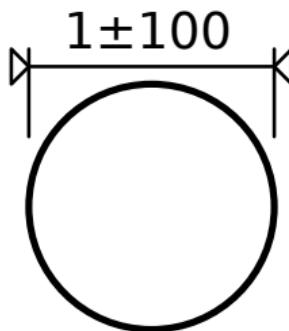
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- Let's aim for 100 ns
- Allow scaling up to "ridiculous" (for a hobby project)

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## Measure stuff



- Airplanes
  - Satellites
  - Background radiation
  - Or even just the temperate

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# Make it a distributed system



- Many simple measurement stations
- networked together
- providing geo-coded data

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- Ideal: build your own
- Realistic: assemble a kit
- Lazy: buy it, plug it in, forget about it

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hackerspace global grid

What is hgg

Who's behind it?

# Who's behind it?

- Just a bunch of folks, really
  - reloc0 & hadez & Timm working on hgg
  - -horn- working on Constellation
  - Paweł, Isaac, and a few others working on various projects

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What we're actually doing

The core idea

# Consolidating existing and new information

- There is already *a lot* of information available
  - HAM radio community
  - Amateur satellite community
  - Hackers & makers
- We're collecting information relevant to the ask
- Improve documentation where we had found details difficult to understand
- Document our findings, results and failures for others to learn from

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- FPGA programming in VHDL
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- Access to infrastructure to deploy your own (measurement) equipment

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# What about applications?

- Constellation

- Track amateur satellites
- Using pseudo-ranging w/ multiple receiver stations
- Once ground stations start gathering and publishing data, the possibilities are endless

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http://www.hackerspaceglobalgrid.org/constellation.html#data-analysis

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  - Live-track background radiation levels
  - Predict orbital paths
  - Determine orbital mechanics
  - Track atmospheric density
  - Determine orbital decay
  - Determine orbital anomalies
  - Determine orbital perturbations

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  - Accurate, geo-referenced time
  - Basis for assisted GPS solutions
  - and many, many more

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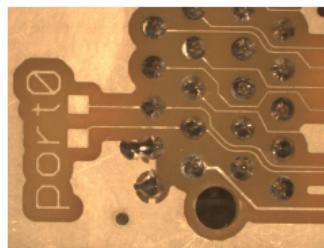
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What we're actually doing

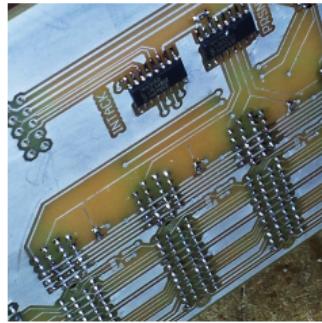
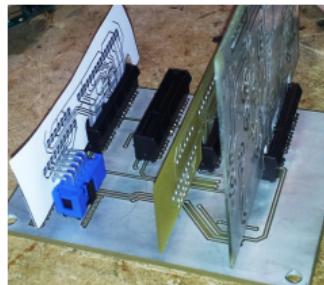
Status quo

# Specification of physical interface between modules



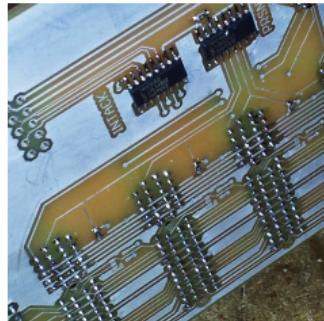
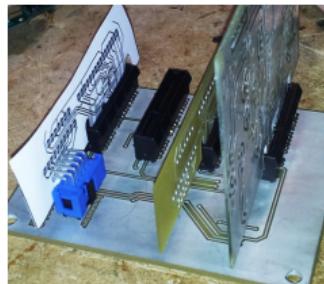
- Modules are connected via a backplane
- PCIe 4x plug w/ custom pinout
- 2x RS485 lanes for inter-module communication
- SPI-ish time broadcast bus
- Differential clock signal for high-res timing signal
- Each module sports storage for calibration data

# friendship0 backplane



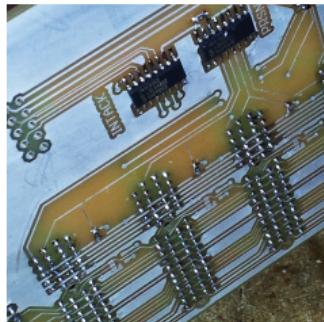
- Four modules slots, one dedicated to bus master module
- ICs for interrupt handling
- Can be easily scaled up, next step eight or nine slots

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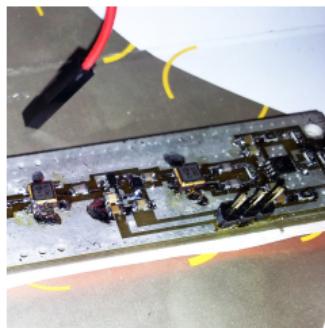
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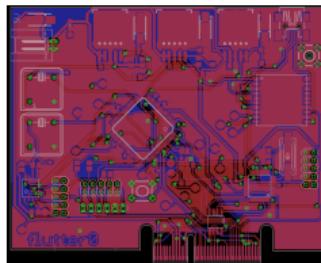
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# dash0 proof of concept



- ADS-B receiver based around miniADSB module
- Easily track commercial aircrafts
- Perfect for verifying pseudo ranging algorithms

# flutter0 high precision distributed time source module



- Spartan3 FPGA for high-res timing (<100 ns)
- ATmega 168 for lo-res timing (1 s to 1/10th s)
- Low cost GPS module w/ external antenna support

hackerspace global grid

What we're actually doing

How to help

# Join us

- We meet almost every Saturday at shackspace, the stuttgart hackerspace

# Keep in touch

- Wiki

- Edit away at <http://hgg.aero/>
- There's a list of open tasks. Pick one or add one!

- GitHub

Check out our GitHub organization to see what projects we're working on and contribute code, documentation, or ideas.

- Public mailing list

Join the mailing list to receive updates about the project and discuss ideas with other members.

- twitter

Follow us on Twitter for news and updates.

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<https://github.com/hackerspace-global-grid> - A public repository containing the code for the Hackerspace Global Grid.

Contribute to the project by creating pull requests.

Check out the [Issues](#) page for a list of open tasks.

- Public mailing list

[global-grid@lists.hackerspace.global](mailto:global-grid@lists.hackerspace.global) - A public mailing list for discussions about the Hackerspace Global Grid.

Subscribe to the mailing list by sending an email to [global-grid+subscribe@lists.hackerspace.global](mailto:global-grid+subscribe@lists.hackerspace.global).

Check out the [Archives](#) for previous messages.

- twitter

[https://twitter.com/hackerspace\\_g](https://twitter.com/hackerspace_g) - Follow us on Twitter for updates and news about the Hackerspace Global Grid.

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- All source code, schematics and layouts available at [github.com](https://github.com)

- Pull requests welcome, or just file an issue if you have a question

- Public mailing list

- [hgg@lists.hackerspace.global](mailto:hgg@lists.hackerspace.global)

- Mailing list archive available at <https://lists.hackerspace.global/pipermail/hgg/>

- If you're not subscribed, just reply to any message

- twitter

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