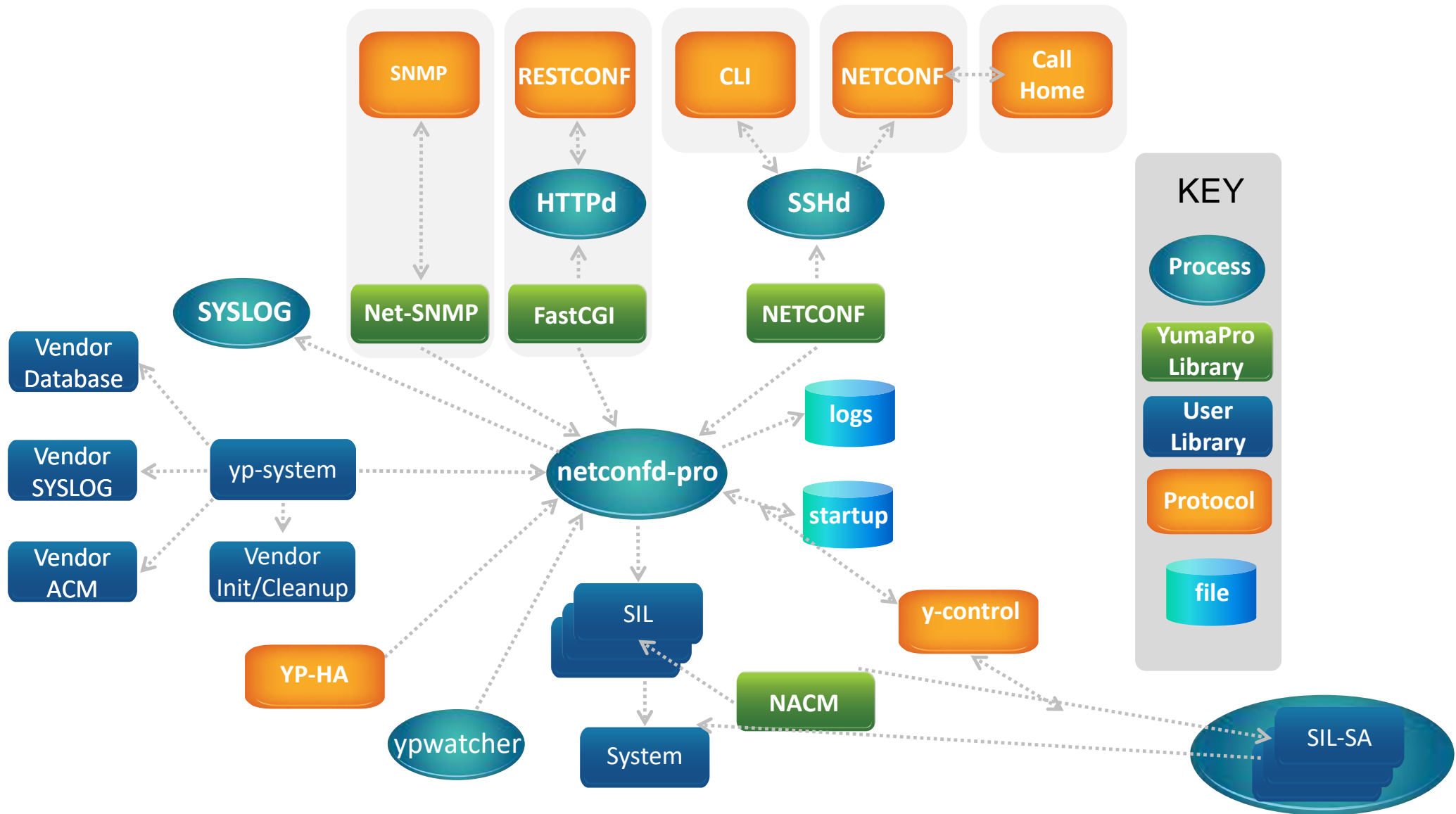# *YANG in Embedded Systems*

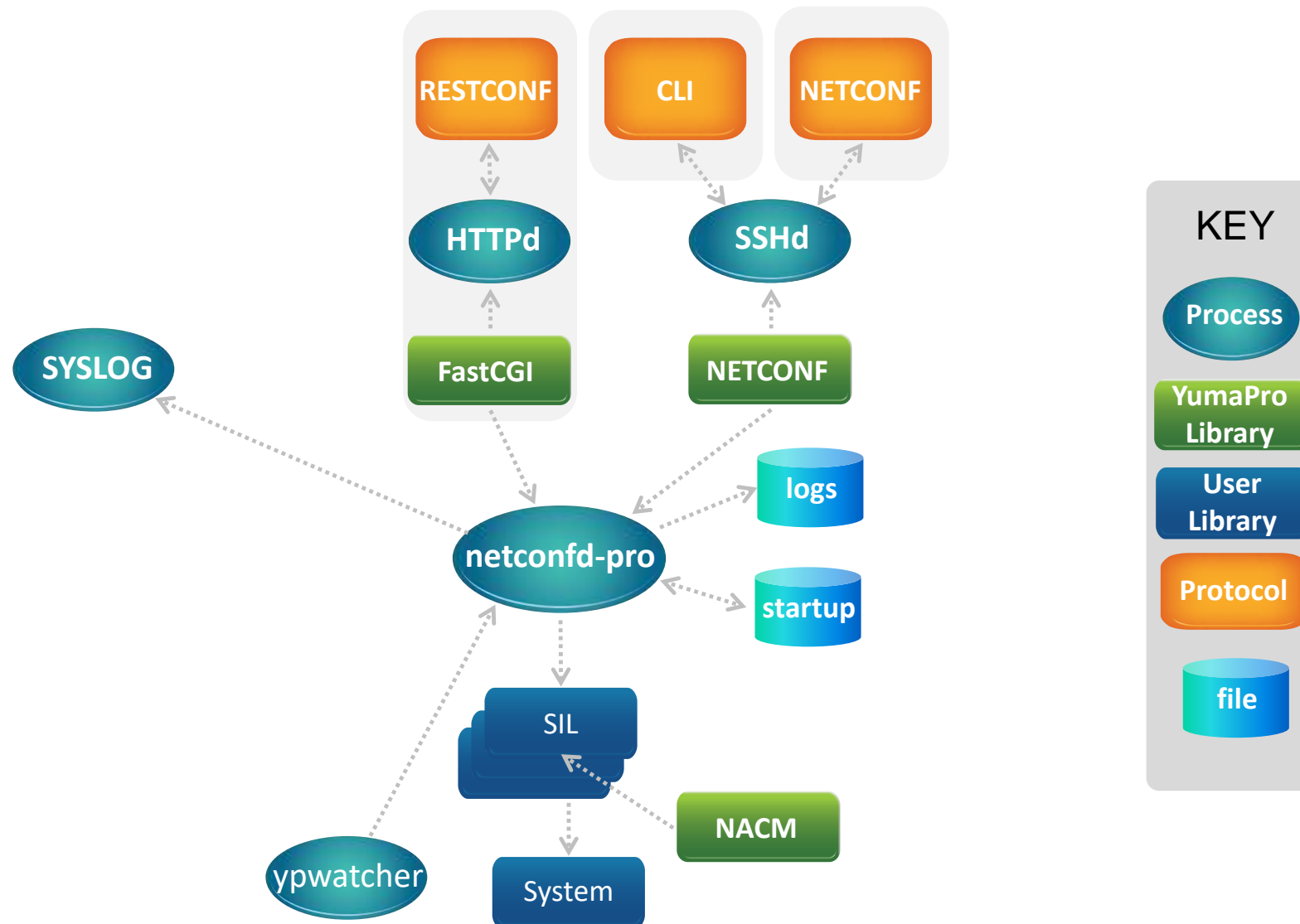*Andy Bierman*
*2017-07-19*

# *Project Goals*

- Adapt full server functionality for use in small embedded Linux platforms, leveraging mature, widely deployed technology

  - Yocto/Bitbake
    - Supports embedded Linux image generation for any size platform
    - Started with core-image-minimal

  - uCLinux
    - Supports very small Linux platform for micro-controllers
    - Many limitations placed on development process, e.g. full static link
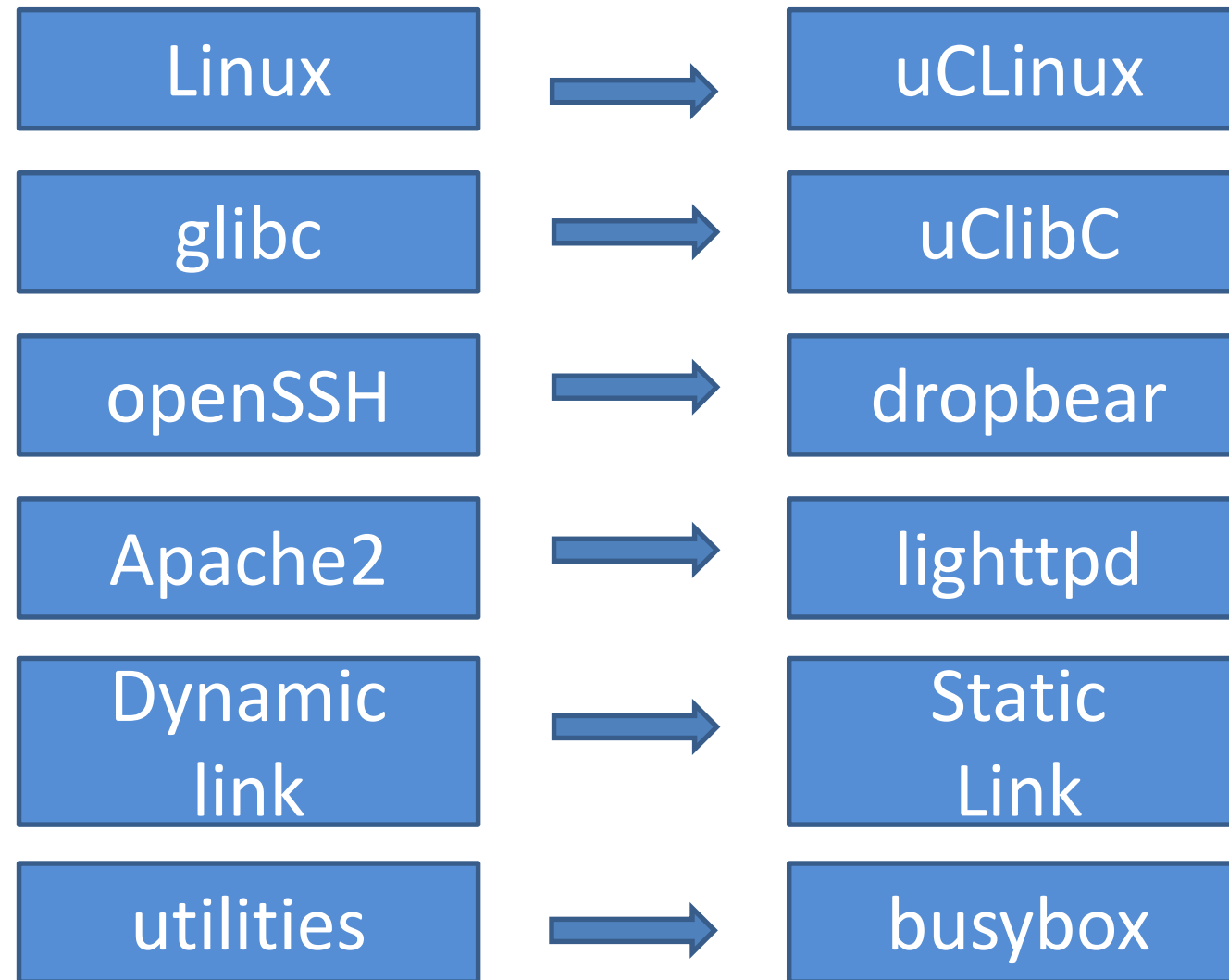    - Target platform was MicroSemi SmartFusion2 (Cortex-M3)

# Full Server

# IoT Server

# Changes For uCLinux

| | | |
|---|---|---|
| Linux | ⟹ | uCLinux |
| glibc | ⟹ | uClibC |
| openSSH | ⟹ | dropbear |
| Apache2 | ⟹ | lighttpd |
| Dynamic link | ⟹ | Static Link |
| utilities | ⟹ | busybox |

# *Project Challenges*

- uCLinux/uClibC has limited functionality

- No dynamic libraries; no dlopen; need full static link including the server instrumentation libraries (SILs)

- Dropbear session startup can be slow; NETCONF operations quite fast after session is established

- Limited filesystem; subset of FHS

- Target board debugging; gdbserver + ssh login to examine server log files

- Easy to reduce server size to 2M; harder to remove libxml2

- Planned RESTCONF/JSON only server should fit in 500K

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# *Conclusions*

- Full feature NETCONF is needed, even in small platforms

- Full transaction management (including confirmed commit) is needed

- Trusted mature packages like dropbear are needed

- Ability to easily add programs to the platform is required

- SSH is still king for secure login; dropbear is very small and lightweight

- Need optimized operations to minimize edit and retrieval network overhead

- Full-size YANG modules are needed for system configuration, notifications