SJTAG Backgrounder

The application of Boundary Scan within complex systems and an introduction to the SJTAG Working Group

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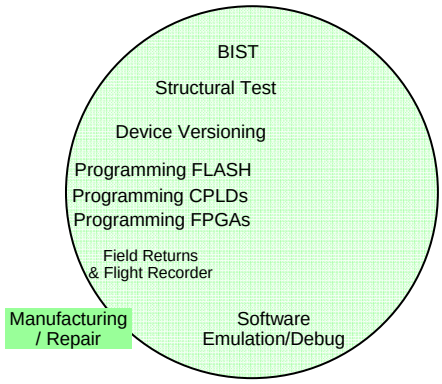
What is SJTAG?

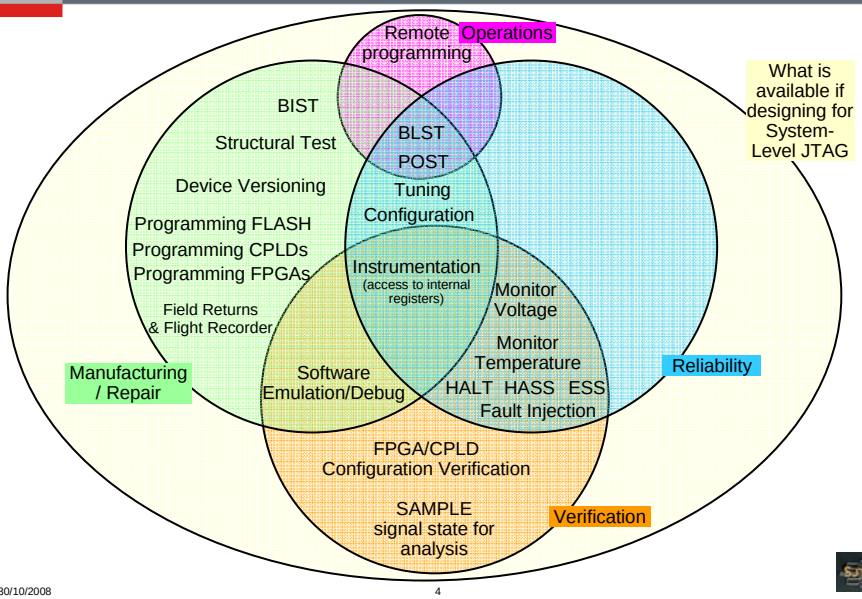
- **SJTAG :: System-level JTAG**
- **SJTAG refers to the use of IEEE 1149.1 based operations with assemblies consisting of multiple boards.**
- **SJTAG implies hierarchical structure that leverages the board level TAPs to enable system level activities**
- **SJTAG extends the scope of possible uses for JTAG to applications throughout the product lifecycle**
- **SJTAG accommodates both external and embedded Test Controllers and Test Managers (XBST and EBST)**

SJTAG Universe



Conventional JTAG Universe

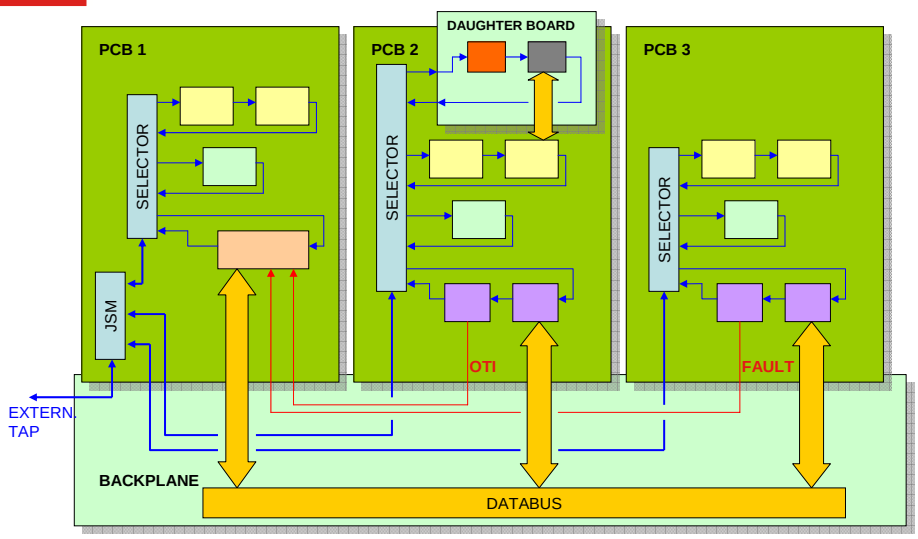
SJTAG Universe



Considerations for SJTAG

- **In general, scan chains resolve to a single TAP at the system level**
  - Need a means to select which board TAP to use.
- **TAP controllers may be embedded or external (or both!)**
  - Management of test execution, results storage and transfer, etc.
- **TAP voltage levels**
- **Boards are connected together (e.g. backplane)**
  - Opportunity to test interconnects between boards.
  - Need to control interaction between boards.
- **Boards within a system may be from multiple vendors**
  - Import/export of test/result vectors.
  - IP protection
- **Flexibility to elect not to install some boards**
  - Identification of system configuration

Board Interaction



Headline benefits

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- **Why should SJTAG be of interest?**
  - Compared to functional testing of a system, SJTAG offers:
    - Deterministic fault coverage
    - More detailed diagnostics (usually)
  - In-field testing and re-programming possible with minimal equipment
    - Laptop and USB JTAG controller
    - Wireless remote access
  - "Covers on" operations:
    - No disturbance to system configuration
  - Systems level applications, such as:
    - Environmental Stress Screening/Testing (ESS/EST)
    - Software debugging/State capture
    - Fault injection
    - More…
    - Individual benefits may be small, but when taken together the overall value is much greater.

Programmable Star Topology

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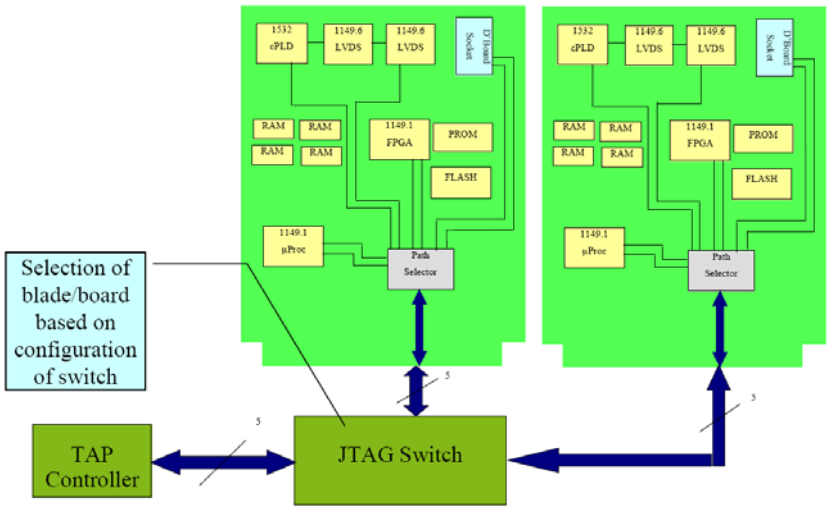

Multi-Drop Topology

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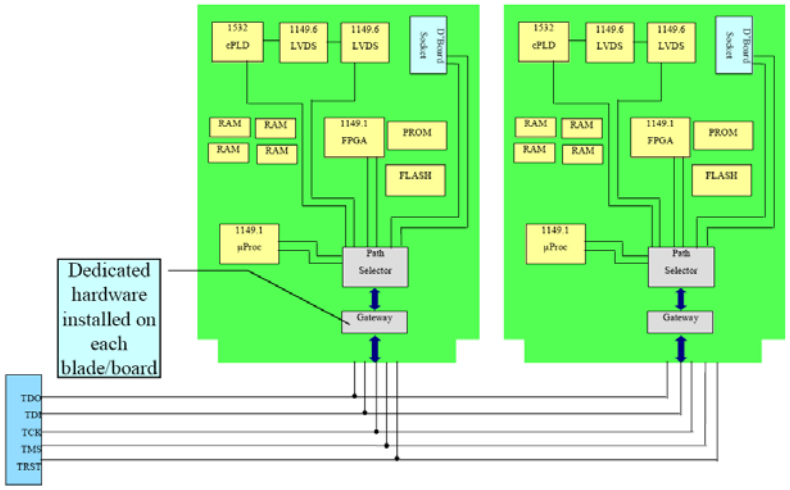

XBST vs EBST

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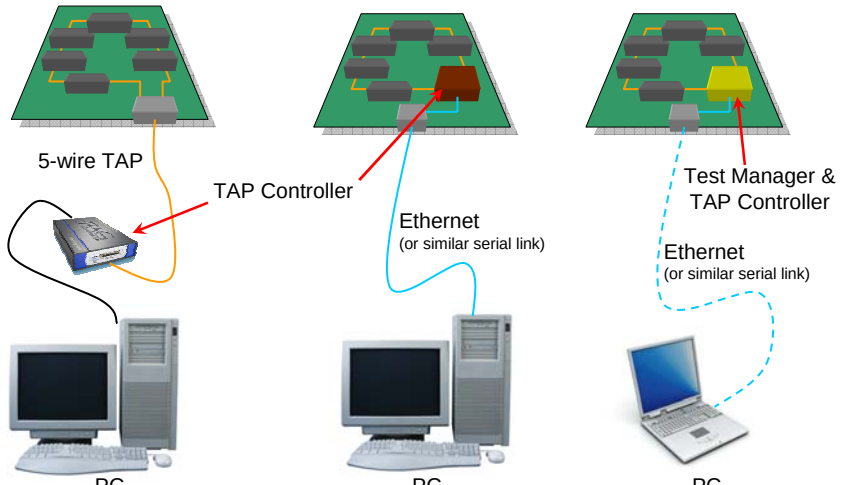

Example: Radar Processor

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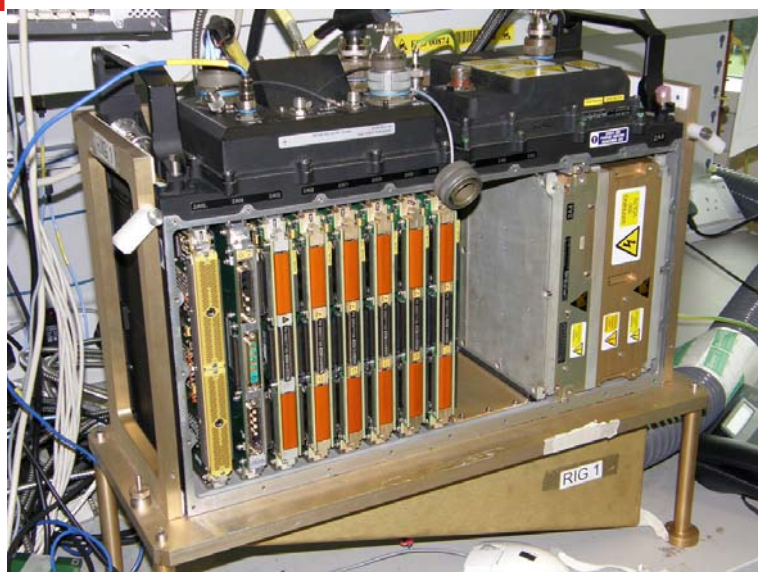

Radar Processor Basic Architecture

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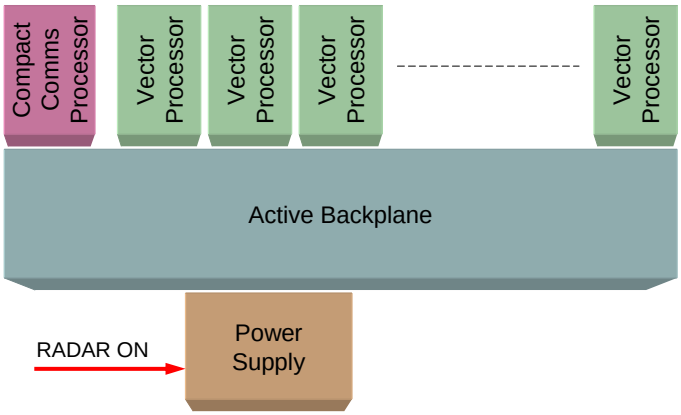
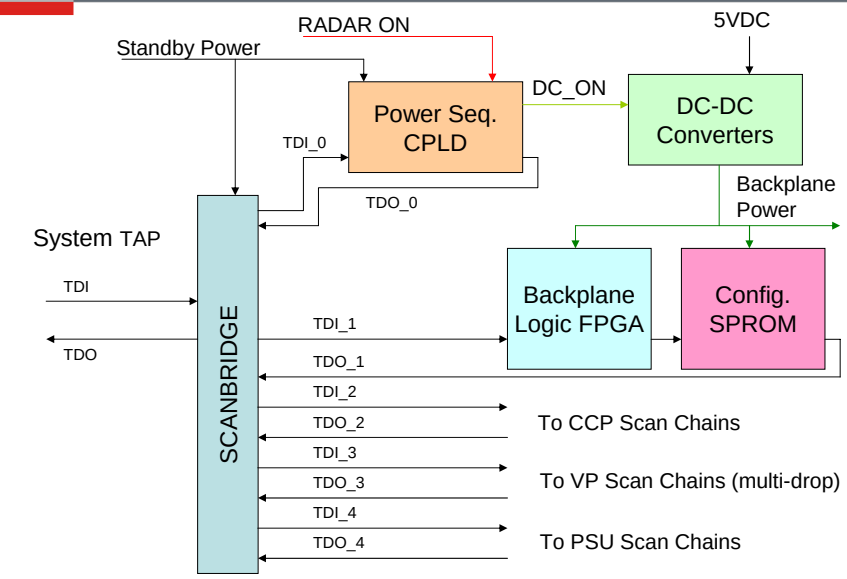


Backplane JTAG Topology



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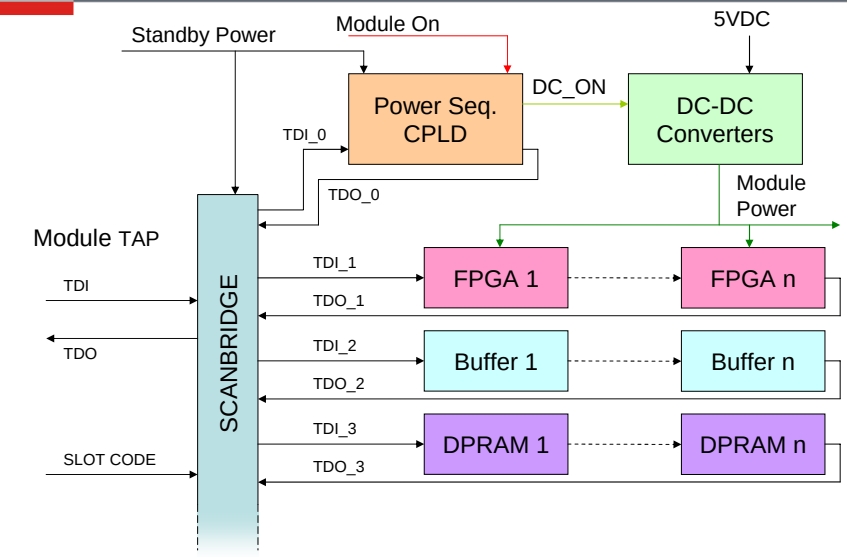
Module JTAG Topology (1)



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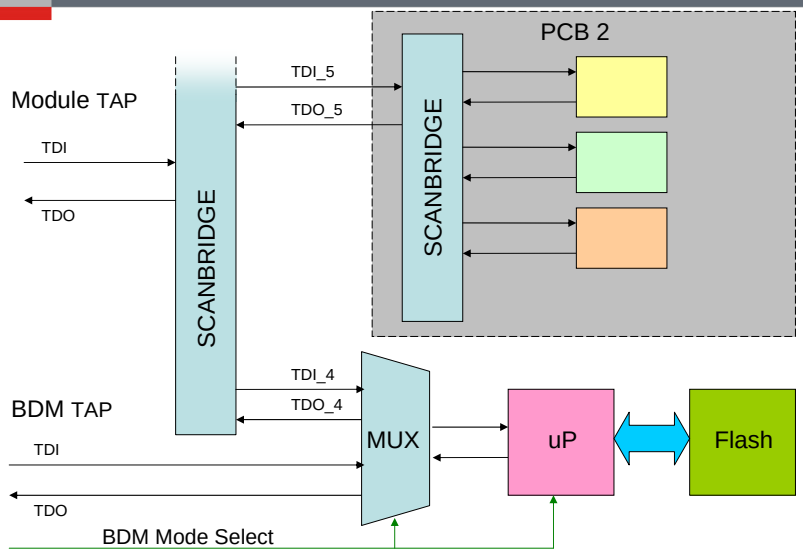
Module JTAG Topology (2)



Problems facing SJTAG implementors

- **Reality is that it's not as simple as just connecting the boards with a scan chain linking device**
  - Not all the necessary information is in the CAD data
- **No single toolset supports all the possible applications**
  - Porting tests between vendors tools is not always easy
- **Many architectures are possible**
  - Tools may support some topologies but not others
  - Topology influences design of TAP interface to boards
- **Problems for the OEM vendor**
  - Data formats for exporting tests and results
  - Security – Protection of IP content in their design

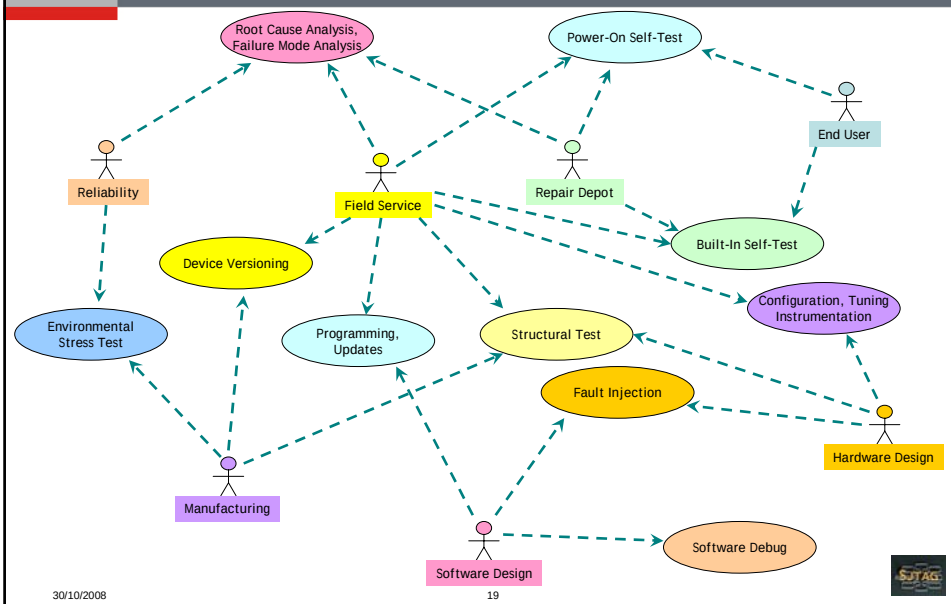
SJTAG Working Group

- **Formed in 2005 at the European Board Test Workshop**
- **Forerunner to the IEEE SJTAG Standard Working Group**
  - Scope and Purpose for IEEE PAR submission prepared
- **Preparing updated SJTAG White Paper**
  - 5 sections – "wiki" allows collaborative writing – *http://wiki.sjtag.org/*
  - Analyzing and Mining common methods/procedures/interfaces through use case analysis
  - Identifying minimum data sets required to support each Use Case
  - Working on value propositions for each aspect of the SJTAG Universe
  - Defining partitions/interfaces in both hardware and software architectures for standardization

Industry Representation

- **Current Working Group membership includes representatives from:**
  - Device vendors
    - National Semiconductor; Firecron; Intellitech Corp.
  - Tool vendors
    - JTAG Technologies; GOEPEL Electronics; ASSET Intertech
  - EDA Vendors
    - Mentor Graphics; Cadence
  - End users
    - Ericsson; Alcatel-Lucent; Huawei Technologies; SAAB Aerotech; Cisco Systems; IBM; SELEX; Eastman Kodak
  - DfT Consultants
    - HDC AB; Integellus; DFT Solutions

SJTAG Use Cases



SJTAG Languages

- **Existing JTAG related languages can divided into three types:**
  - Those that detail the execution of a test or other JTAG operation ("canned vectors") – SVF, JAM/STAPL
  - Those that help define the JTAG capabilities of a device or chain of devices – BSDL, HSDL
  - Those that describe the flow and control of a series of operations – Frequently tool vendor proprietary languages
- **But for system-level JTAG tooling to work effectively we also need:**
  - The structure/composition of the system – could be dynamic
  - Constraints – possible reset conditions, contentions
  - Not everything is available from the CAD data!

System Data Elements

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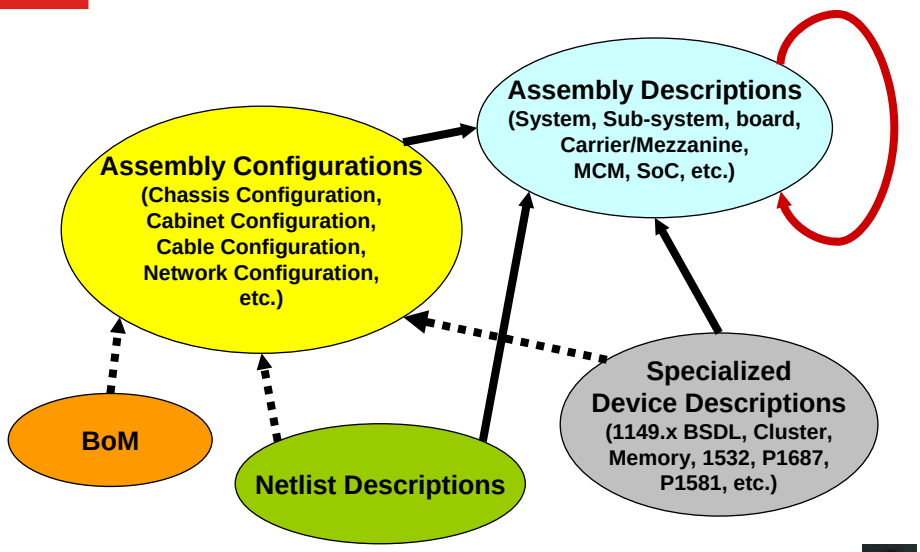

SJTAG Website

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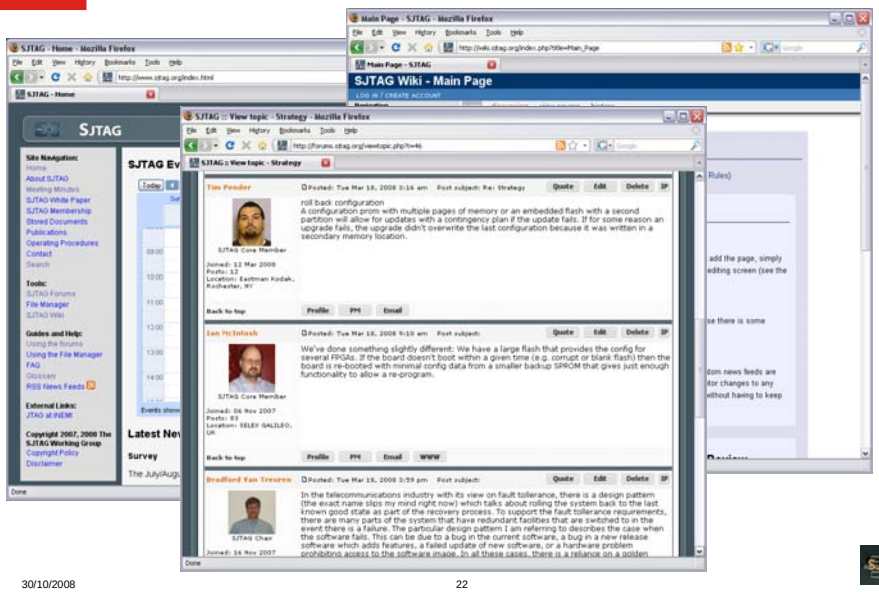

SJTAG Communications

- **Weekly meeting by conference call**
  - One-hour discussion – main topics decided in advance by chair.
  - Occasional “live” meetings, usually at conferences such as VTS or ITC.
- **On-line presence**
  - SJTAG website provides access to meeting minutes, documents and presentations, and on-line discussion forum:
    http://www.sjtag.org/
  - Monthly newsletter for members and “fringe observers”

Participating

- **It is a principle of the IEEE that anyone can contribute to, or comment on, the development of IEEE standards**
  - The SJTAG Working Group believes it one of the most open and accessible groups currently operating
  - Documents, presentations and meeting minutes are available from the SJTAG website
  - You can self-register to use the discussion forums or add to the Wiki – you do not have to be a member of the Working Group
  - If you do want to join the Working Group and play an active role, then contact us through the website

Questions?

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