

Operational State

TANGO Device state is the operational state of the device or system it models (and includes the state of the TANGO Device).

- In some cases, the TD is external to the device (system) it models.
- In SKA Telescopes in many (most?) cases the TD is a part of the system it models.

Examples: A TANGO Device models:

- physical device
 - motor
 - LRU
 - Power supply
- 3rd party provided system (hardware + software)
 - Server
 - Cluster
 - Network switches
 - HVAC
- **subsystem (hardware + software):**
 - DISH
 - MCCA
 - CSP
 - SDP
- **functionality** (implemented in software + firmware + hardware, usually using hardware in a shared manner with other TDs):
 - Subarray
 - Pipeline
 - Correlator
 - Beam-former
 - TPM
- software sub-system
 - Example ?

The items emphasised in bold is what we have concentrating so far.

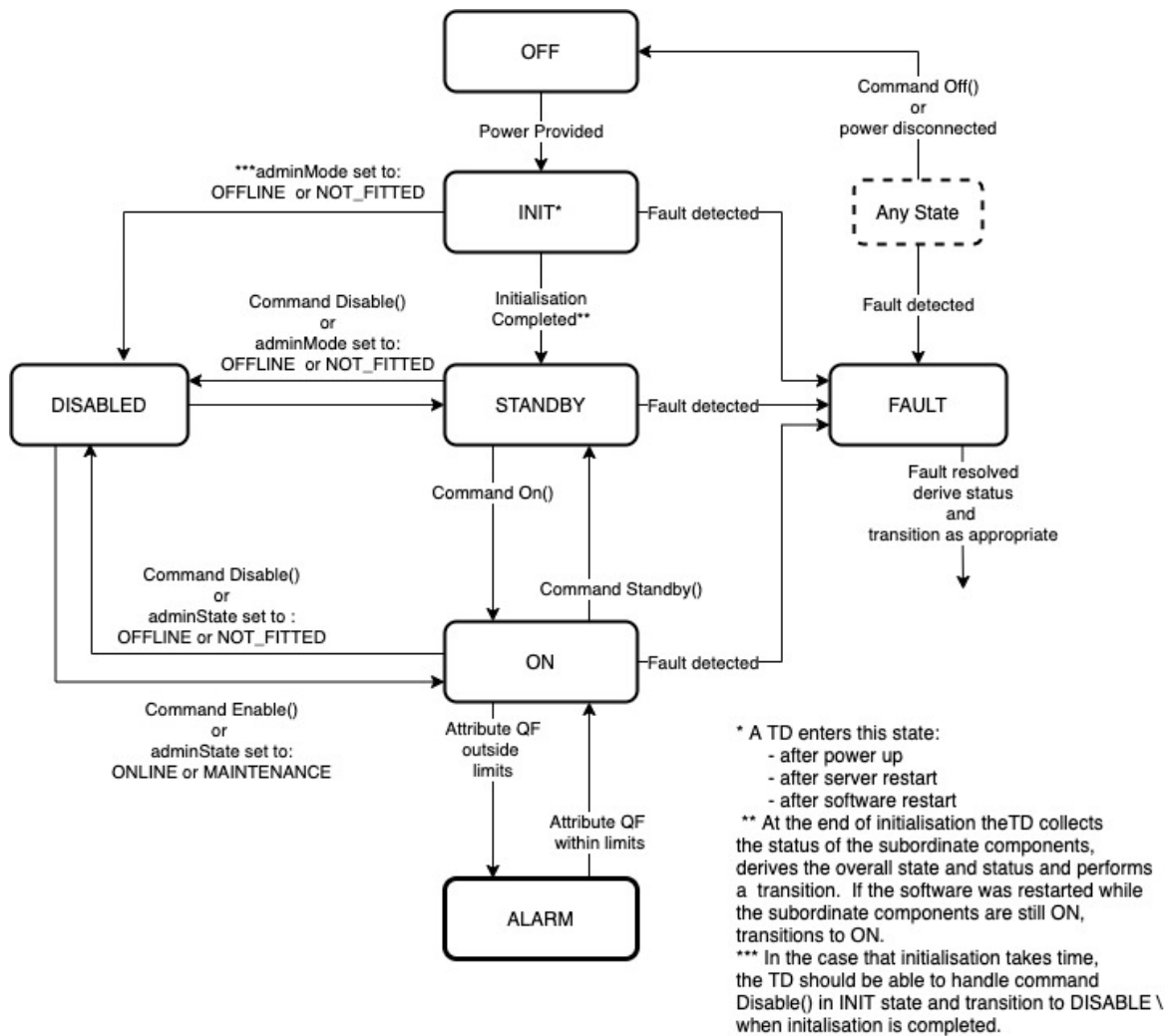


Figure 1 Operational State Transitions for devices that implement STANDBY

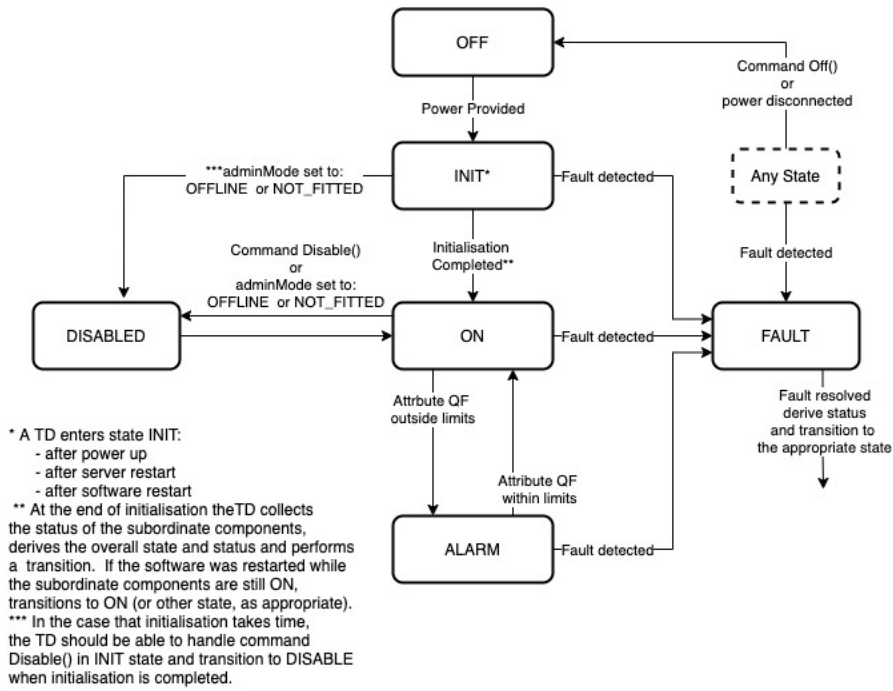


Figure 2 Operational State transitions for devices that do not implement STANDBY

State	Description	Comments / Issues
OFF	The device / sub-system is turned OFF, power is not provided (connected).	<p>In the case where the TD is part of the sub-system it is modelling, this state is never reported by the TD itself, but can be reported by other system (a client) if the client controls and/or monitors supply of power.</p> <p>If a device is unresponsive and the client cannot detect whether power is connected, the state should be reported as UNKNOWN.</p>
INIT	TANGO Device is being initialized. During or after TD initialization, the TD may be programmed to perform initialization of the subordinate components.	<p>Q: How does TD knows whether or not to re-initialize subordinate components?</p> <p>For example, if CSP.LMC software is restarted while other sub-elements (CBF, PSS, PST) are ON there is no need to for CSP as a whole to transition to STANBY. At the end of initialization, the TD collects the status of the subordinate components, derives overall state and performs transition as appropriate.</p> <p>If other components are already ON leave them ON.</p> <p>Alternative approach would be to define a property Target State, which would allow a client (TMC) to set the target state for a TD (device, subsystem). After the power loss, TMC instantiates, populates and configures the TANGO DB before starting other sub-systems. For MCCSand CSP the default setup would be targetState=STANDBY. When a command On() is received, CSP sets the target state to ON.</p> <p>Perhaps the Target State is not needed, after initialization, the TD may leave subordinate components as-is, collect their status, derive overall status, report to client(s), and the client (TMC or human operator) decides whether to perform state transition. Requires more thought.</p>

State	Description	Comments / Issues
STANDBY	In SKA required for the large sub-systems (LFAA, CSP, CBF, PSS): system uses less than 5% of nominal power. Master M&C Servers and network is up, other hardware is OFF.	Most TDs do not implement this state and proceed directly to ON. Observing Devices use hardware in shared manner and do not implement this state (sub-array, pipeline, individual beamformers, VCCs, FSPs). Example: When CSP is in STANDBY, the CSP subarrays are OFF. The same may be applied for the telescope.
ON	Device / sub-system is powered, initialized and ready to be used.	All TDs implement this state. Note: not all subordinate sub-systems and components have to be ON for the TD to transition to ON. The minimum set of components required for transition to ON has to be determined for each TD (Telescope, DISH, LFAA, CSP, SDP). As soon as a telescope is able to collect, process and output data for a single dish or station, the telescope can transition to ON (but can be in ALARM and/or report degraded health).
ALARM	A 'sub-state' of ON, implemented by the TANGO core. A quality factor for one of the attributes is outside the pre-defined limits, the TD may or may not be functional (much of the functionality may still be available).	The TD may return to ON without external (human or automatic) intervention.
FAULT	A fault which requires external (human or TANGO client) intervention has been detected.	Q: When the fault is resolved, how does the TD know to which state to 'return' (ON or STANDBY). 1) check the status of the subordinate components, derive and report status; 2) do not turn ON / OFF / STANDBY other components wait for TMC instructions (instructions from a client). Must be implemented with care!! There may be cases where reset/restart of subordinate components will be needed.

State	Description	Comments / Issues
DISABLE	<p>Component / sub-system should not be used (for its core purpose). In general, the behaviour could be defined as: rejects commands but answers queries (but some commands should be accepted, e.g. transition to OFF). In TANGO the original intent was that the TD transitions to DISABLED based on the status of the subordinate component(s) which it models. The SKA uses this state for a different purpose.</p> <p>Have to define what does this mean for each TD !</p>	<p>In most cases the TD can:</p> <ul style="list-style-type: none"> • Report status as required. • Functionality related to observing (collecting and processing data) is disabled. <p>Questions: Do we need this state ??? Should a TD transition to DISABLE when adminMode is OFFLINE or NOT-FITTED? Is it better to let TD report the actual state and use the adminMode to filter alarms and events?</p>
UNKNOWN	When is this reported?	<p>If a client can determine that power is not provided or that the device is turned OFF it should report the TD state as OFF. If a TD is unresponsive when it should be ON isn't it better that the client reports it's state as FAULT ? If a TD finds that the subordinate components are unresponsive the state should be reported as FAULT.</p>

Example:

TANGO Device	State	Comment
CSP Master reports state	STANDBY	
CSP.LMC network switch	ON	All CSP.LMC switches
CSP.LMC Server	ON	All CSP.LMC servers
CSP.LMC software		Software is up and running, TDs report status as appropriate for devices/functionality they model
CSP subarray	OFF	All subarrays
CBF Master reports state	STANDBY	
CBF Master Control Server	ON	All servers
CBF network switch	ON	All switches
CBF Master Control Software		Software is up and running, TDs report status as appropriate for devices/functionality they model
VCC	OFF	All VCCs
FSP	OFF	All FSPs
CBF subarray reports state	OFF	All subarrays
PSS Master reports state	STANDBY	
PSS Master Control Server	ON	
PSS network switch	ON	
PSS Master Control Software		Software is up and running, TDs report status as appropriate for devices/functionality they model
PSS nodes (servers)	OFF	All nodes
PSS pipeline	OFF	All pipelines
PSS subarray reports	OFF	All subarrays
PST Master reports state	ON	
PST network switch	ON	
PST master server	ON	
PST Master Control Software		Software is up and running, TDs report status as appropriate for devices/functionality they model
PST nodes (servers)	OFF	All nodes
PST pipeline	OFF	All pipelines